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SIGNAL SOURCE 210

CCTV TEST PATTERN GENERATOR

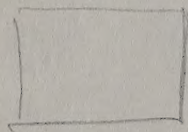
INSTRUCTION MANUAL
VISUAL INFORMATION INSTITUTE, INC.

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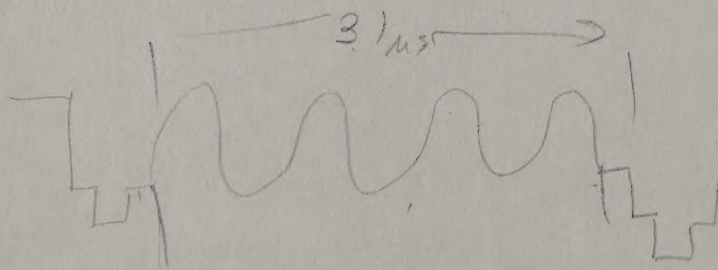
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SIGNAL SOURCE 210
CCTV TEST PATTERN GENERATOR

INSTRUCTION MANUAL

Series D

VISUAL INFORMATION INSTITUTE, INC.

Box 33 / Xenia, Ohio 45385 / Phone (513) 372-8637

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NOTICES

This instruction manual contains all essential information for the proper connection and use of the Signal Source CCTV Generators; the manual contains maintenance information as well.

This device contains circuits which are considered proprietary. Duplication of Signal Source equipment is not authorized without the express written consent of Visual Information Institute, Inc. These instruments, as described in this manual, are manufactured under U.S. Patent No. 3,483,479, plus other domestic and foreign patents pending.

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In rare instances, there may appear in this equipment a deviation from the part as called out on the schematic and in the parts list. This is especially true in the case of semiconductor devices, diodes, and transistors, where a number of types are interchangeable. The right is reserved to make use of interchangeable components where such substitution will provide equal or superior performance to that specified. It is suggested that if replacements are required, the type specified in the parts list be procured.

You are urged to read the instruction manual completely before connecting the Signal Source Generator for operation. Observance of only a few procedures will provide greater operator convenience, and will assure most effective application of the equipment as well as provide maximum safety to the user.

CAUTION

Even low voltages commonly present in transistorized circuits are potentially dangerous. Additionally, full line voltage is present on fuse terminals, power switch terminals, and other exposed points within the interior of the unit, and are accessible when the cover of the equipment is removed. Caution should be exercised, as follows:

- a. Remove power by unplugging the line cord when removing covers and inspecting interior of the unit.
- b. Observe the common safety practices when servicing equipment (dry skin, insulation of the body from ground, etc.).
- c. Never work on electrical equipment when alone.

APPLICATIONS

Television test patterns developed by Signal Source Generators are employed primarily in the alignment and performance analysis of closed-circuit and studio television equipment. Generally alignment is performed in conjunction with test charts developed by the Electronic Industries Association (EIA), Washington, D.C. Further information regarding television tests and measurements is available through Visual Information Institute, Inc.

Signal Source CCTV Generators are designed to be used with any closed-circuit television system (those which do not place the video signal upon a r-f carrier). Application is equally successful with interlaced, EIA-Sync, or random interlace, white-positive video systems, to systems of any scanning rate, including rates set forth by EIA Standards RS-170, RS-330, RS-343, and RS-375, from 525- to 1029-line as well as European 625-line, 50 cycle and other systems. It is necessary only to perform calibration adjustments inside the generator to be compatible with the scanning rate in use at any particular time.

The Signal Source Generator develops complete video signals that will generate the display of precise patterns as selected. The nominal output levels are 1.0 volt video (including blanking pedestal), plus 0.4 volt sync. The generator is source terminated from proper drive of 75 ohm coaxial line. The output may be adjusted readily to supply a video signal of 0.786 volt in conjunction with a 0.214 volt sync level. Internal adjustments permit operation with a non-composite output (no sync) if desired.

This instrument develops the following set of test patterns to test areas considered critical to the development of a high quality television signal and display.

Bar (Crosshatch), Dot, and associated V Bar and H Bar patterns determine the quality of geometric proportion of a television display raster.

Gray Scale: A series of "stairsteps" ordinarily composed of eight levels of gray in ascending order from black plus black and white levels which compose the common ten step gray scale pattern. This signal tests the ability of a device or system to reproduce shades of gray between black and white extremes.

Flat Field: A uniform signal to produce a uniform level of brightness over all areas of the display. This signal is also useful in determining brightness produced by the display.

Window: A low frequency, low duty cycle (large area) pattern used to evaluate low frequency response nad whose transition from black to white permits evaluation of transient response characteristics of a display.

V Stripe: The horizontal component of the window signal on every scan line in the television field. The transitions from black-to-white and white-to-black permit evaluation of transient response without the interference of low frequency distortions which may be introduced by the lower duty cycle Window signal.

Resolution: A series of closely spaced, alternate black and white bars evaluating the ability of the display to produce fine detail information.

Each of these signals is described in detail in the following text.

Signal Source generators produce exceptionally sharp risetimes, up to 10 nsec. Many systems and components generate distortion when such sharp transitions are introduced. Units are provided from the factory with risetime limited unless otherwise specified. A capacitor on the Signal Output board may be changed, per schematic, to increase or decrease output signal risetime as desired for any particular application.

Resolution modulation depth is directly related to the bandwidth and risetime capabilities of the system. Signal Source instruments are designed to provide full, 100% modulation to quite high resolution content. However, at higher rates a roll-off may be evident as limited by risetime. Also even short lengths of coaxial cable will load high frequency information, reducing the modulation level to less than full black-to-white excursion.

WARRANTY

Signal Source equipment is guaranteed to be free of defects in material and workmanship for a period of 1 year from date of shipment, when operated in accordance with the instructions and specifications provided. Such warrant is made in lieu of any other guarantee or warranty, express or implied, and is offered only to the original purchaser. If such defects are confirmed through our inspection, the product will be repaired or replaced, at our option, without charge to the purchaser for parts or for labor. This warranty does not cover damages which occur in shipment or due to misuse or abuse of the apparatus, and is not applied to cables or decorative, stained, or painted finishes.

Those requesting adjustment through the terms of this warranty are instructed to contact the factory for authorization to return the equipment before shipment. Items for which authorization is issued are to be sent prepaid.

Signal Source equipment is designed and constructed using the most effective and safest industrial practice known, and in accordance with printed and accepted practices for fabrication of industrial electronic equipment. Inasmuch as Visual Information Institute, Inc. has no control over the manner in which the instrument is used, or over systems into which the equipment will be interconnected, the corporation cannot and does not assume any liability for circumstances or damages arising from use of this equipment.

This warranty does not apply to equipment which has been modified in any way to other than the original factory configuration.

ACCESSORIES AND SERVICE

The Signal Source equipment is designed for long, reliable service under adverse operating environments. It should require a minimum of maintenance or service if properly applied.

Visual Information Institute, Inc. stands ready to assist in advising as to proper application of its products, to aid in servicing instruments, and to help in CCTV system layout and operation for maximum of utility in the application of television in all areas.

A number of accessories are available for extended operation of Signal Source equipment, including special housings, cables, etc., especially designed to suit unusual requirements. Special configurations of Signal Source generators are available for integration into existing or contemplated systems, such as units without cases, special accessory functions brought to the front panel, etc.

If your equipment should malfunction or develop operating difficulty, the factory supports a liberal service and overhaul program for a fixed labor fee plus cost of parts, transportation, and insurance. Prompt attention to your equipment is pledged; do not hesitate to contact the factory in these instances.

TECHNICAL SPECIFICATIONS

CCTV TEST PATTERN GENERATOR

Signal Source 210

This specification defines the physical and functional characteristics of a transistorized Television Test Pattern Generator for use in the test and evaluation of closed-circuit television equipment. The Signal Source, designed to be compatible with any television scanning rate, develops reference video patterns which are automatically synchronized to incoming drive signals or to accessory internal sync generator.

ELECTRICAL CHARACTERISTICS

<u>Functions</u>	-Window	+V Stripe	+Window	- V Stripe	-H Bars
	-Bar	+Gray Scale	+Bar	Flat Field	-V Bars
	-Dot	+H Bars	+Dot	+V Bars	-Gray Scale

+ .. Plus denotes white pattern on black raster background or ascending gray scale.

- .. Minus denotes black pattern on white raster background or descending gray scale.

Resolution - Signals which develop an alternate black-and-white bar pattern display are produced at the selected repetition rate to develop the desired number of "resolution lines". Adjustable repetition rates provide selectable patterns at the following resolution:

100 lines 300 lines 500 lines 700 lines 900 lines Bar
200 lines 400 lines 600 lines 800 lines 1000 lines Multiburst

Resolution may be presented as a continuous pattern across the television horizontal line or as Bursts separated by either black, gray, or white signal level for Minimum, Medium, or Maximum APL, as selected. The user may also select a reference Black/White bar pattern which is composed of the reference bar plus a burst of each resolution density from 100 to 1000 lines. A control panel Variable position permits resolution testing between the standard increments.

Gray Scale - adjustable to linear or log characteristic as desired, at Minimum, Medium, Maximum APL, or full raster.

Mode - All patterns may be used in a CALIBRATED MODE, as internally preadjusted. Or, selection of VARIABLE mode at the front panel switch permits variation of pattern proportion as desired over a range suitable for any scan rate in common use.

All of the above functions develop signals as described in the following text.

Output Signal

Composite Video Signal

- Level - video portion adjustable from 0 to a maximum 1.0 volts.
 - sync level adjustable from 0 to 0.4 volts.
 - blanking (pedestal) adjustable from 0 to 0.125v maximum.
- Polarity - White Positive.
- Impedance - 75 ohm, source terminated.
- Risetime - 30 nanoseconds nominal.
- Types of Signal - Video Only (no Blanking or Sync).
 - Noncomposite Video (includes Blanking).
 - Composite Video (includes Blanking and Sync).

Input Signal Requirements

Accessory internal sync generator is available, deleting input requirements.

- Types - V Drive.
 - Mixed Blanking.
 - Mixed Sync.
- Level - Nominal 4 volt peak, minimum 1 volt.
- Polarity - Negative-going pulses.
- Impedance - 75 ohm fixed termination, high impedance bridging input switch selectable.
- Risetime - 1 usec maximum.

Scan Rates - Any. System automatically synchronized to input drive signals, regardless of rate.

Power Requirements

- Frequency - 50 cps. to 400 cps.
- Voltage - 105 to 125 volts rms.
- Power - 40 watts.

Stability

Internal voltages regulated to $\pm 1\%$, 5 mv ripple max, temperature compensated.

MECHANICAL CHARACTERISTICS

- Enclosure - Metal cabinet with four feet. Accessory packages available for standard 19" rack mount brackets, carrying handles, or chassis slide.
- Size - 17" w x 10 1/2" h x 16" d.
- Weight - 35 lbs.
- Temperature - 0° C to +55° C.
- Humidity - up to 95%.
- Connectors - BNC series.

NOTE: In the interest of product improvement these specifications are subject to change without notice.

INSTALLATION

Signal Source instruments are supplied from the factory for free-standing bench use in the normal cabinet-model fashion.

The basic cabinet is provided with four rubber feet so that the instrument may be employed as a free-standing bench instrument, in which case the unit is ready for use as unpacked. A number of accessories are available for the cabinet for greater convenience, as follows:

Rack Mount Tabs - addition of a bracket to the sides of the cabinet prepare the unit for mounting in a standard 19 inch rack. If the unit is installed in an enclosed rack, top and bottom covers should be removed to permit proper flow of cooling air. In all cases, establish that sufficient ventilation is provided to maintain ambient temperature within the specified range, and that heat from adjacent units does not cause undue temperature buildup.

Chassis Slides - addition of chassis slide accessory plates permit installation of the unit into a 19-inch equipment rack on slides to permit front "drawer" access to the equipment. In such installations observe precautions on temperature and cooling air as outlined above.

Carrying Handle - an accessory handle set may be attached to the cabinet sides for greater convenience in carrying the instrument in field applications. In such cases the top and bottom covers of the unit remain intact.

Prior to initial operation, establish that all the circuit boards are placed into their proper position, and that they are firmly seated into the connector.

The instrument must be provided with an appropriate supply of alternating current, nominally at 120 v., 50/60 cycle. It is strongly recommended that three-wire single phase wiring (one wire grounded) be employed for maximum safety to personnel operating this or other types of electronic equipment.

CONNECTIONS

POWER is applied to the Signal Source Generator by inserting the line cord into a 120-volt 50/60 cycle a.c. receptacle, and turning the power switch to ON position. The red pilot light indicates that power is applied and the unit ready for operation.

INPUT SIGNALS to this generator should be 4.0 volt, negative-going pulse trains of high quality, as fed from a 75 ohm coaxial cable. Signals may be introduced at rear of unit, where auxiliary jacks are provided for bridging the signal to another unit if desired, or the switch on the rear connector panel may be switched to terminate all input lines to the proper characteristic impedance. All signal lines are routed to the front panel of the generator also, for convenience in monitoring input signals or for front panel connection of the inputs if desired. The following signals are required, as illustrated in Figures 1 and 2.

V DRIVE - To control development of vertical elements in the Bar or Dot pattern.

BLANKING - Mixed Blanking, containing both H and V pulse components, is used for development of the 0.05v (nominal) blanking "setup" in the video output signal and for control of H rate pulse in the unit.

SYNC - Will develop the 0.4v (nominal) sync portion of the output signal. This input may be removed for development of a Noncomposite video signal which does not contain the synchronizing portion of signal.

VIDEO

OUTPUT - Of variable amplitude signal portion, fixed level of blanking and sync (internally adjusted). This signal should be routed through coaxial cable of the proper characteristic impedance to the point of utilization.

H Drive input is not required for operation of the generator, but may be connected if desired for convenience in oscilloscope synchronizing, etc.

CONNECTIONS (continued)

Rear connector panel switching provides four positions for the following uses of accessory internal sync generator if provided:

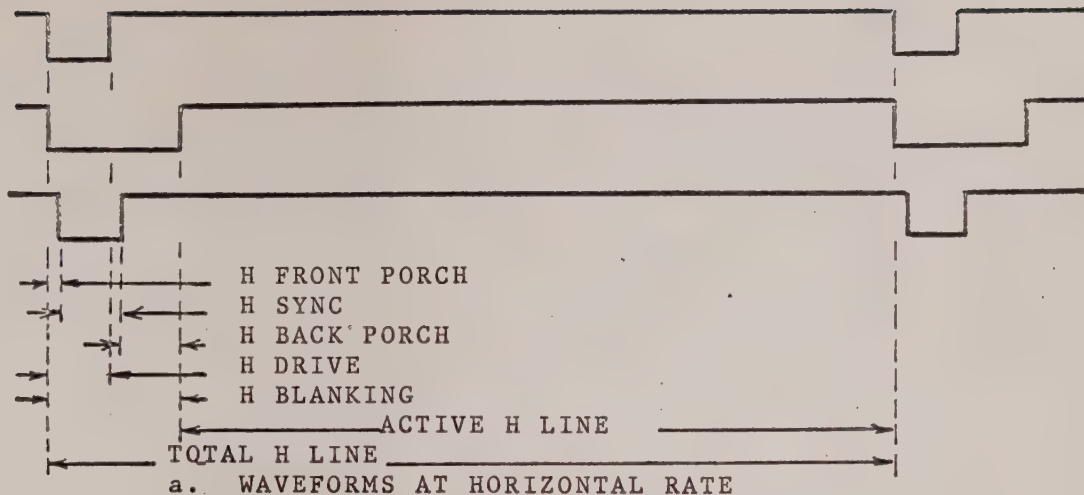
<u>Switch Position</u>	<u>Label</u>	<u>Function</u>	<u>Use</u>
Extreme Counter clockwise (1)	Hi Z	External sync bridged	Use of sync from external source, "loop-through" connection.
Next position clockwise (2)	TERM	External sync terminated	Use of sync from external source, all lines terminated.
Next position clockwise (3)	INT	Internal sync	Use of internal sync. Rear panel connectors out of circuit; External source need not be disconnected.
Extreme clockwise (4)	OUT	Internal sync and output	Use of internal sync, also sync output on rear connector panels for use elsewhere.

All sync waveforms as used in pattern development are presented at front panel for reference, whether from internal or external source.

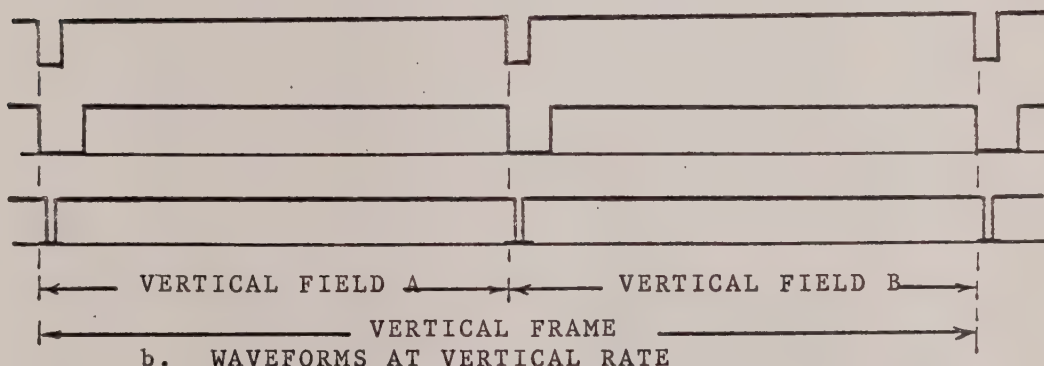
If no sync generator is provided, the last two positions will not be of functional use in the generator.

If the sync generator accessory is included, the unit serial number will identify the type of generator; a separate instruction manual is provided for the accessory.

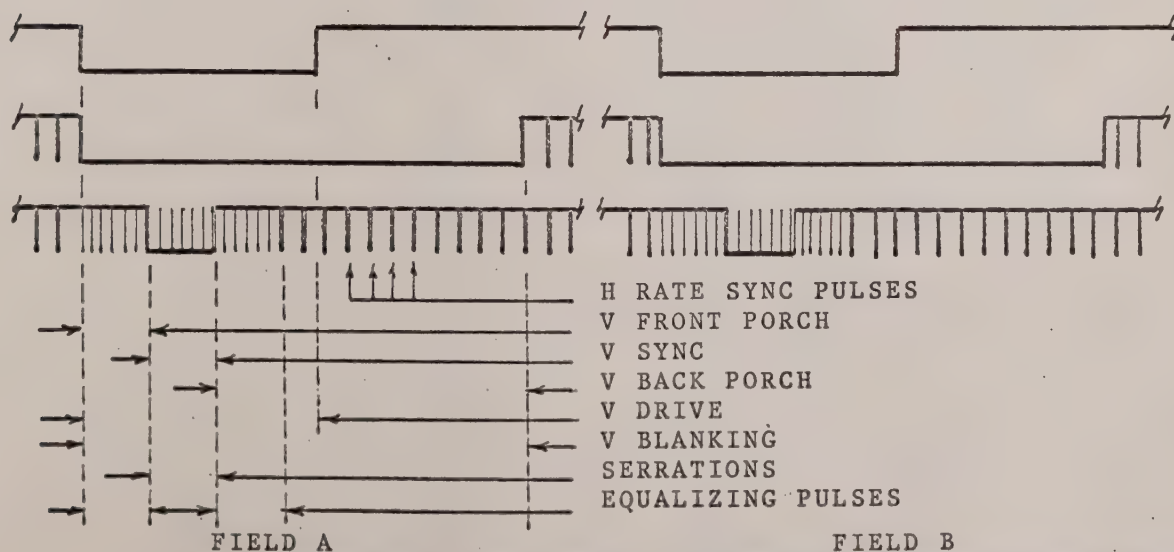
H DRIVE
(optional)
BLANKING
SYNC



V DRIVE
BLANKING
SYNC



V DRIVE
BLANKING
SYNC



c. EXPANDED VIEW, DETAIL OF VERTICAL INTERVAL WAVEFORMS
FIGURE 1 - TYPICAL INPUT WAVEFORMS

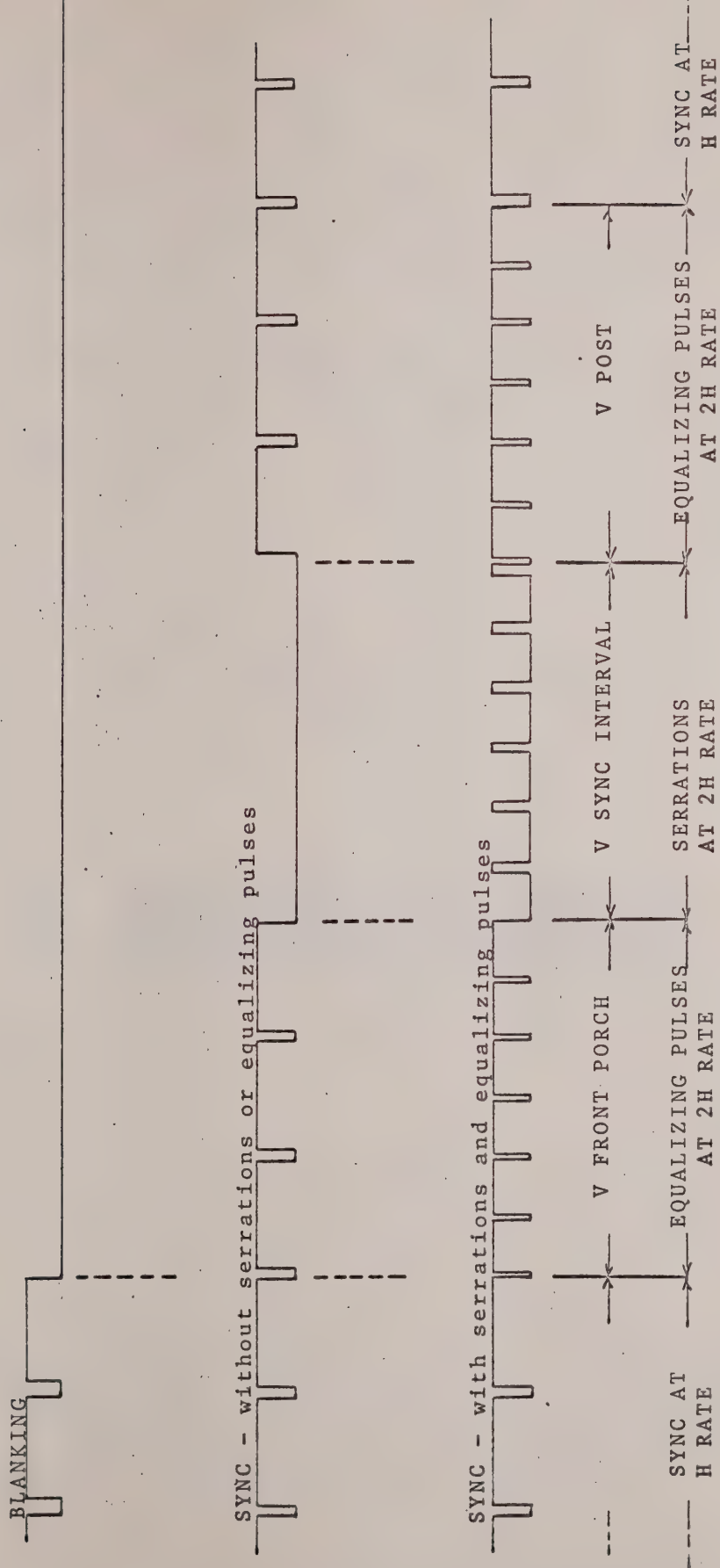
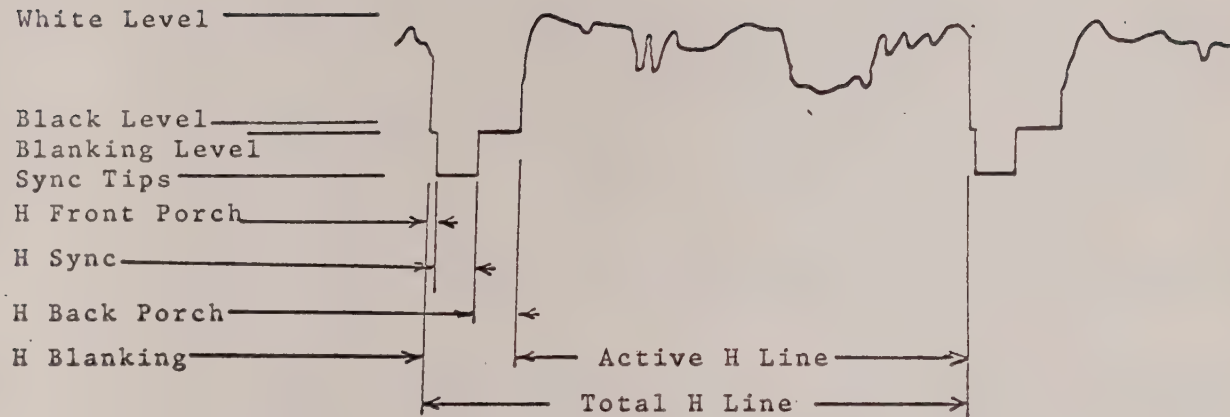
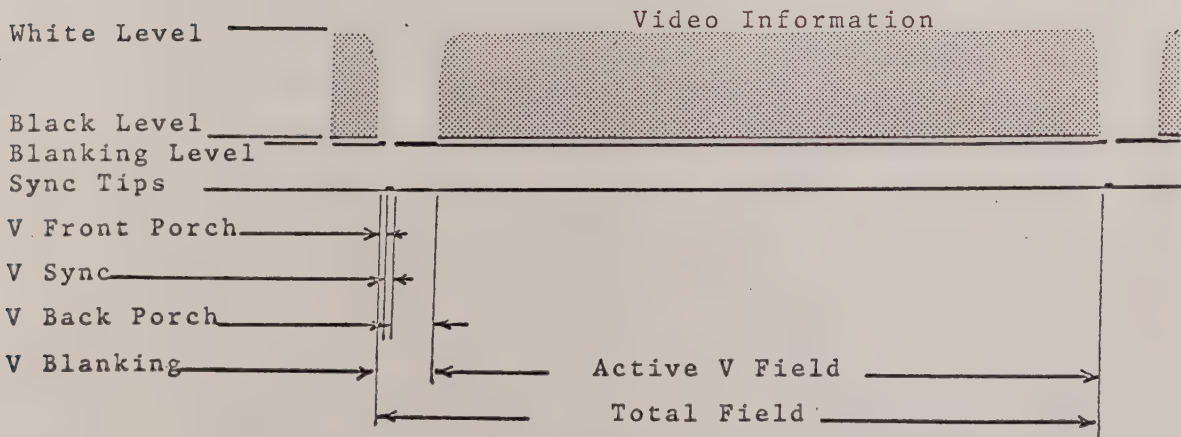


FIGURE 2 - DETAIL OF TYPICAL INPUT SYNC SIGNALS.

OUTPUT SIGNALS



a. At Horizontal Scanning Line Rate



b. At Vertical Field Rate

Figure 3 - Typical Video Waveforms

The basic video signal is composed of Video, Blanking, and Sync as shown above to form the "Composite Video Signal." Various significant parameters and common terminology applied to them (such as "Front Porch" and "Back Porch") are outlined above. In some instances a "Non-Composite" video signal may be used which is the same as that shown above less the Sync portion, composed of only the Video plus Blanking.

BAR, DOT, H BAR, V BAR

The four patterns of this category are all related, derived of common proportions.

The BAR pattern (also referred to as "grating" or "crosshatch" is a grid pattern composed of horizontal and vertical lines.

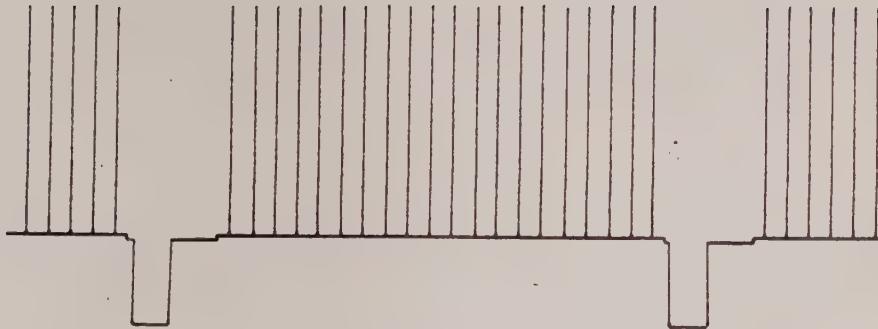
The H BAR pattern is composed of only the horizontal elements of the Bar pattern.

The V BAR pattern is composed of only the vertical elements of the Bar pattern.

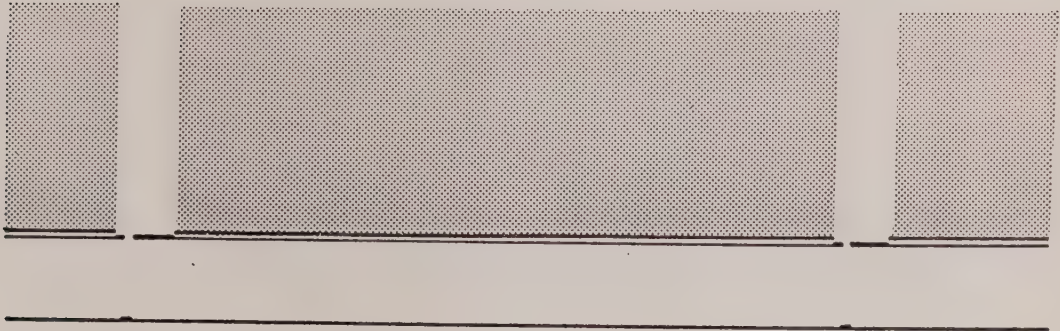
The DOT pattern provides a series of dots only at the location of the intersection of horizontal and vertical elements of the Bar pattern.

Based upon the precedent of practice used in 525-line systems of a broadcast nature, the proportion for these patterns has become a visible 17 elements in the horizontal and 14 elements in the vertical dimensions of the raster. This was done originally due to the convenience of generating elements in the vertical plane at 15 times the vertical rate, one of which was obscured by the vertical blanking interval. The common 4 x 3 aspect ratio then dictated a corresponding generation of elements at 20 times the horizontal scanning rate, three of which are obscured by horizontal blanking.

For use of other aspect ratios, a similar proportion must be derived from comparison with the raster height. For instance, the use of a 1:1 aspect ratio will require 14 visible elements in the active horizontal line (divide the active line time by 14) to obtain V Bar element spacing as well as 14 active elements. The precedent has carried over into other scan rates to permit utilization of commonly available Linearity Test Charts for all rates, as used in conjunction with electrically generated patterns for linearity adjustments in television cameras and display devices. This has been done without regard to the varied blanking percentage (inactive portion) at the different scan rates. Therefore pattern calibration must be based strictly upon the basis of the active (visible) portion of the raster only.



a. Typical V BAR signal at Horizontal rate.



b. Typical V BAR signal at Vertical rate.

Figure 4 - Oscilloscope view of the V BAR signal waveform,
White Polarity

Calibration of the V BAR is complicated by the fact that current standards do not provide a constant percentage of inactive blanking time for the various scan rates. Therefore adjustment must be based upon the active time of the television scanning line only. Based upon the 525-line, 4:3 aspect ratio precedent, calibration for this rate provides element spacing of 0/20 total line time, or 3.17 usec., between elements. Referred to the nominal active time, elements occur at intervals of $.0605t$ (t =active line time). Therefore the calibration of width between adjacent V Bars shall be based upon 0.0605 times the active line duration for all scan rates, providing 17 visible bars in the length of a scanning line for the 4 x 3 aspect ratio or $0.071t$ for the 1 x 1 aspect ratio.

=====

Figure 5 - Oscilloscope display of the H Bar signal waveform at Vertical rate, White Polarity

Calibration of the H Bar or other elements in the vertical plane of the pattern is based upon 15 elements spaced equally in the total vertical television field, including blanking time. The vertical field is produced at 60Hz for all scan rates described by present U.S. EIA Standards; therefore the repetition rate for H BAR elements is 900 Hz, requiring 1,111 usec between the elements. One of the 15 elements will occur within the vertical blanking interval and will not be visible. For practical purposes, the pattern is composed of 14 visible H Bars in the vertical plane of the active raster. Considering the exact amount of the raster obscured by vertical blanking, it is necessary to generate 13.88 intervals between H Bars, each interval 1,111 usec.

It is necessary, in an accurately generated pattern, for the H Bar element to occur for one complete scan line, positively locked so as to preclude drift or "run through" that will permit intensification of partial lines, etc. Otherwise an error of at least one scan line width can occur in the display of the pattern.

These factors present a conflict; 1,111 usec is not an even multiple of the scanning line time for any of the EIA Standard scan rates. Therefore it is necessary to accept a compromise in interval timing. The vertical interval between H Bars is allowed to vary from 1,080 usec to 1,143 usec as set forth in Table I. This provides the desired visible 14 elements of H Bar, slightly off the 15th multiple of vertical field rate. This difference will not be noticeable except when the pattern is used as an overlay with the EIA Linearity Chart for measurement of Geometric Proportion by EIA and IEEE standard technique.(1) In those instances the pattern is useable by adjusting the chart size to match the electrically generated pattern.

(1) Further information regarding this measurement technique is available from Visual Information Institute, Inc., Xenia, Ohio.

TABLE I
H Bar Interval Timing

Scan Rate	Nominal Req'd Spacing	Actual Timing Minimum	Maximum
525	17.5 lines	17 lines=1,080 usec	18 lines=1,143 usec
675	22.5 lines	22 lines=1,087 usec	23 lines=1,136 usec
729	24.3 lines	24 lines=1,097 usec	25 lines=1,143 usec
875	29.3 lines	28 lines=1,064 usec	29 lines=1,102 usec
945	31.5 lines	31 lines=1,098 usec	32 lines=1,134 usec
1023	34.1 lines	33 lines=1,076 usec	34 lines=1,108 usec
1029	34.3 lines	33 lines 1,069 usec	34 lines=1,102 usec

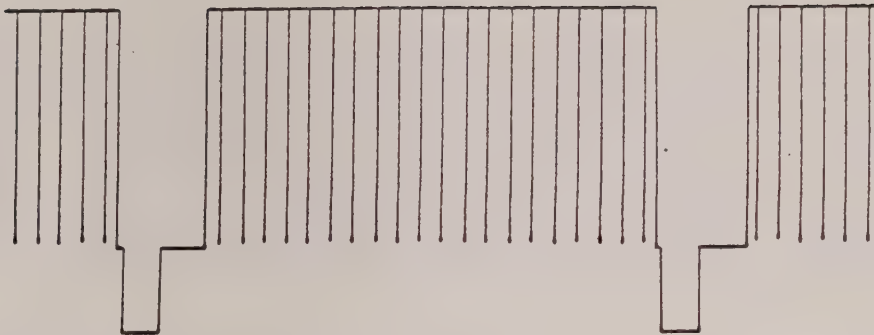


Figure 6 - Oscilloscope display of the typical V BAR signal waveform at Horizontal rate, Black Polarity

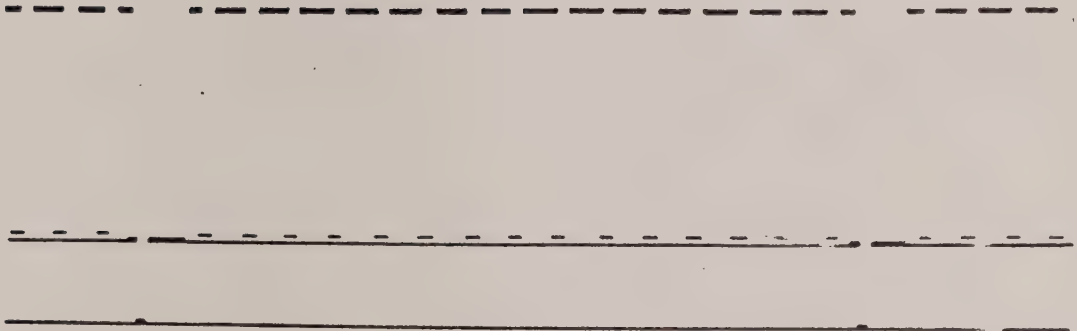


Figure 7 - Oscilloscope Display of the typical H BAR signal waveform at Vertical Rate, Black Polarity

This instrument provides the pattern in either White polarity or Black polarity, as selected at the front panel. White polarity provides a white pattern element on a black background, as shown in Figures 4 and 5. A black element developed on a white background is generated in the Black polarity, as shown above. Signal timing and calibration is the same in either instance.

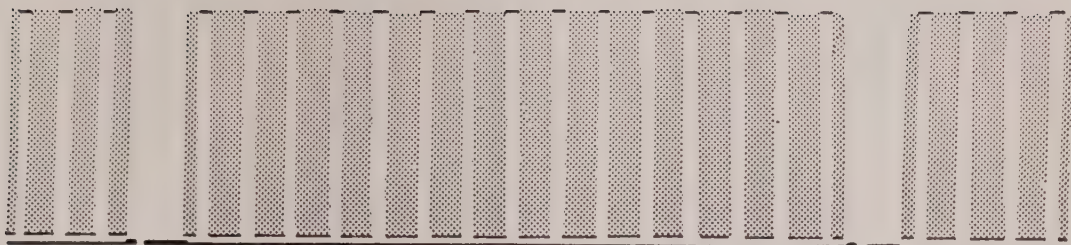


Figure 8 - Oscilloscope display of the BAR signal waveform at Vertical rate, White polarity.

Inasmuch as the Bar and Dot patterns are composed of the H Bar and V Bar elements, it is not necessary to provide a separate calibration procedure for these patterns.

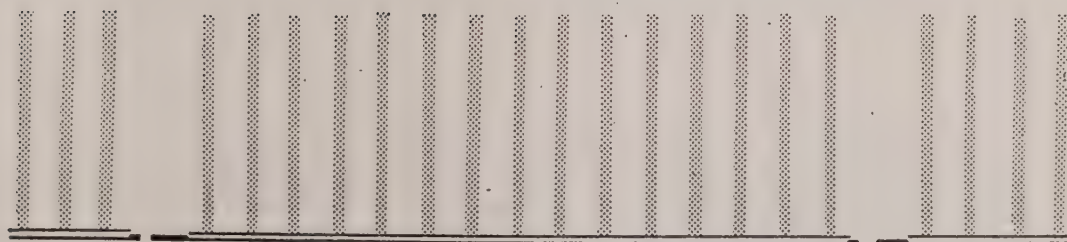
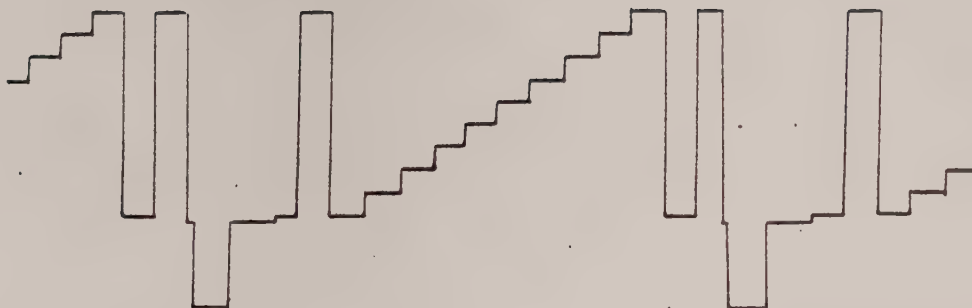
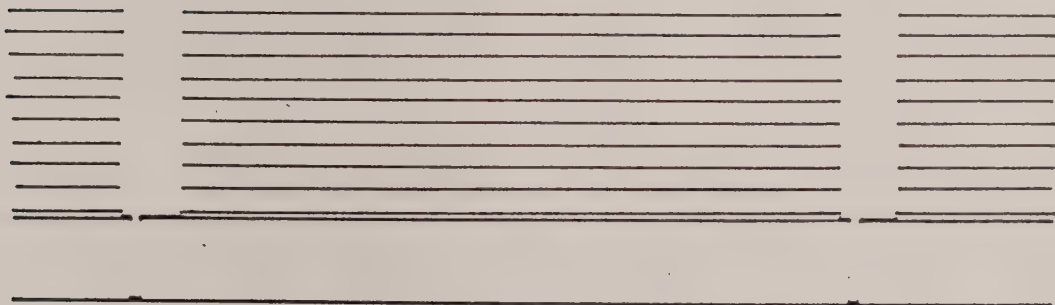


Figure 9 - Oscilloscope display of the DOT signal waveform at Vertical rate, White polarity.



a. Typical linear GRAY SCALE signal at Horizontal rate.



b. Typical linear GRAY SCALE signal at Vertical rate.

Figure 10 - Oscilloscope view of the GRAY SCALE signal waveform, Ascending Mode, Full Raster.

GRAY SCALE

The gray scale signal is composed of ten levels of brightness, including black and white. Therefore the traditional "ten step" scale actually is composed of nine risers, and eight shades of gray between the extremes. The signal also contains a white flag before the ascending scale and a black flag after the scale to provide a 100% contrast reference at each end of the displays.

Existing standards and common practice call for a linear gray scale test signal (one with all steps of equal amplitude).

The signal as described above provides a nominal 50% APL (Average Picture Level), representative of "typical" television scenes.

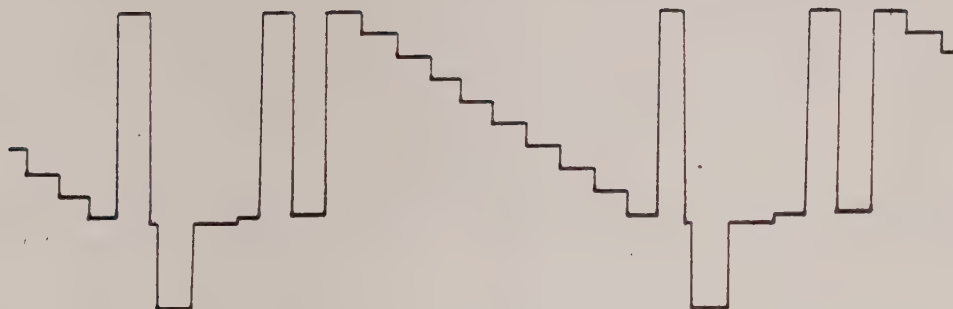
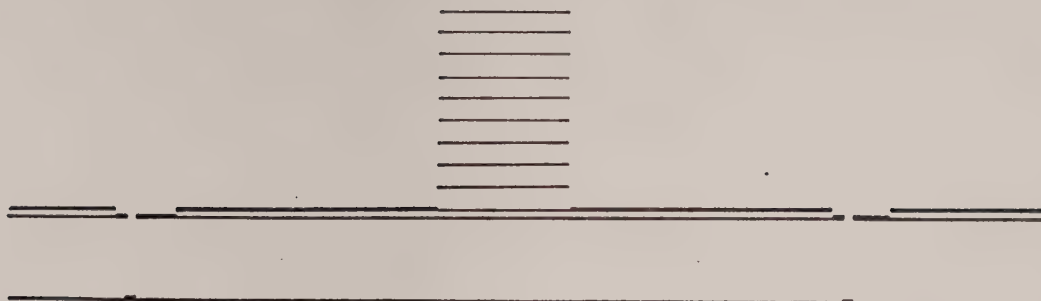


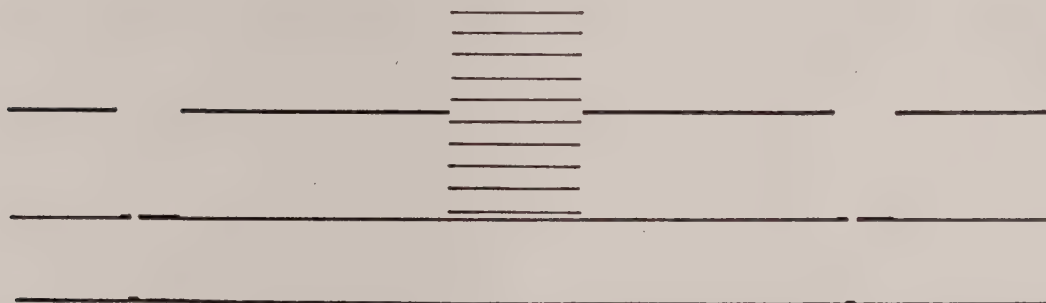
Figure 11 - Oscilloscope view of the GRAY SCALE signal waveform. Descending Mode, at Horizontal Rate.

The instrument also develops the gray scale signal in a descending mode, as shown above. This permits the evaluation of possible amplitude distortion (clipping or non-linear compression) at either side of the television raster. Calibration and APL remain the same as for the Ascending Mode.

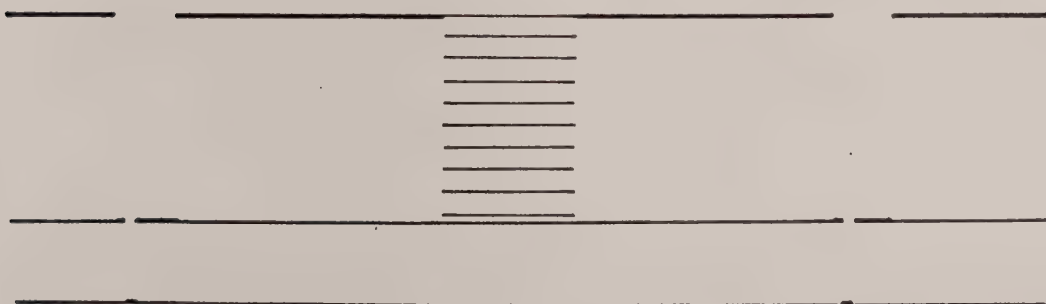
The gray scale signal also can be developed at various Average Picture Levels. A band of gray scale is developed at the center of the raster so that a photometric evaluation of gray scale reproduction can be conducted, if desired. The band is adjustable, nominally to a width equal to 20% of the raster height. The remainder of the raster is selectable as black, gray, or white level to provide an overall minimum (10%), medium (50%), or maximum (90%) APL. Switching between these conditions will readily display any shift which occurs in gray scale development. Waveforms for the various APL conditions are illustrated in Figure 12.



a. Typical GRAY SCALE signal at Minimum (10%) APL

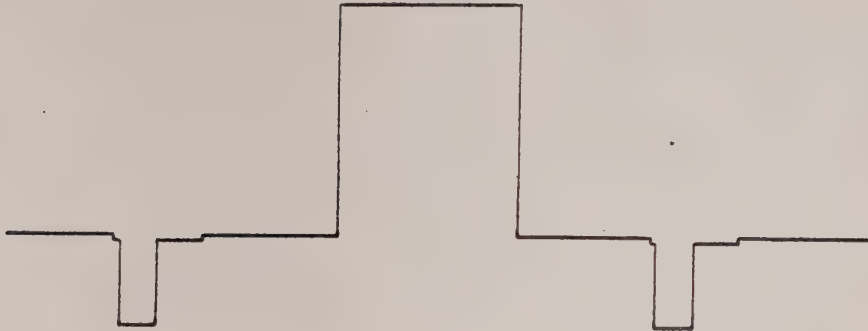


b. Typical GRAY SCALE signal at Medium (50%) APL

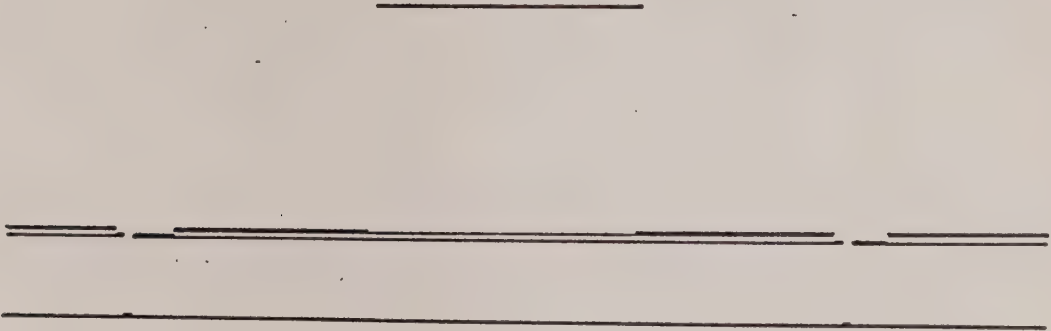


c. Typical GRAY SCALE signal at Maximum (90%) APL

Figure 12 - Oscilloscope view of the GRAY SCALE signal waveform, at Vertical Rate, for various APL.



a. Typical WINDOW or V STRIPE signal at Horizontal rate.



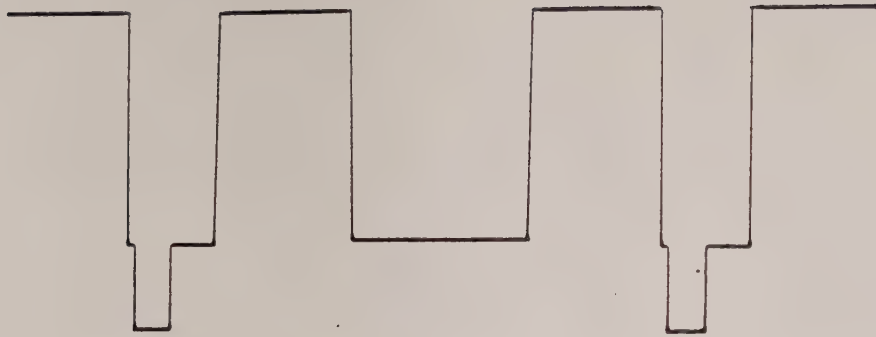
b. Typical WINDOW signal at Vertical rate.

Figure 13 - Oscilloscope view of the WINDOW or V STRIPE signal waveform, white polarity.

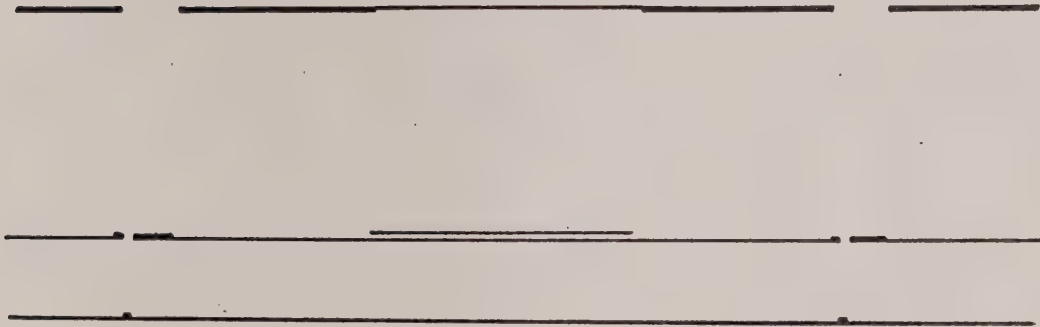
WINDOW

The window offers a low duty cycle test. A central white area is proportioned to provide a 20% duty cycle (Average Picture Level). This is surrounded by a uniform black background over the remainder of the raster. Standard proportions of the white area are $0.414h$ (41.4% of the active portion of horizontal line) and $0.414v$ (41.4% of the active portion of the vertical field).

The sharp transition from black to white and white to black at the edges of the window in the horizontal dimension provide a convenient tool for analysis of transient response also.



a. Typical WINDOW or V STRIPE signal at Horizontal rate.

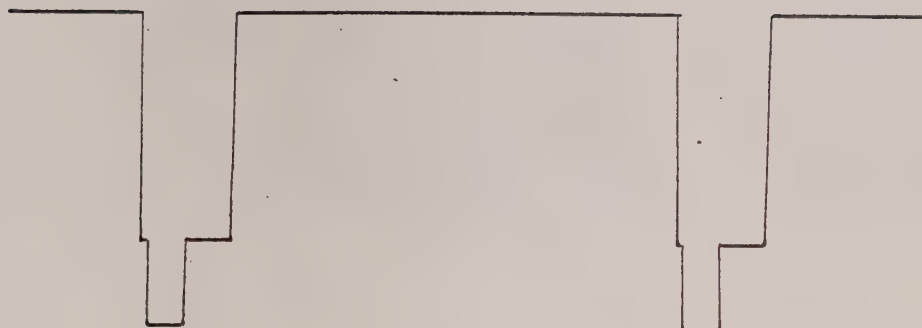


b. Typical WINDOW signal at Vertical rate.

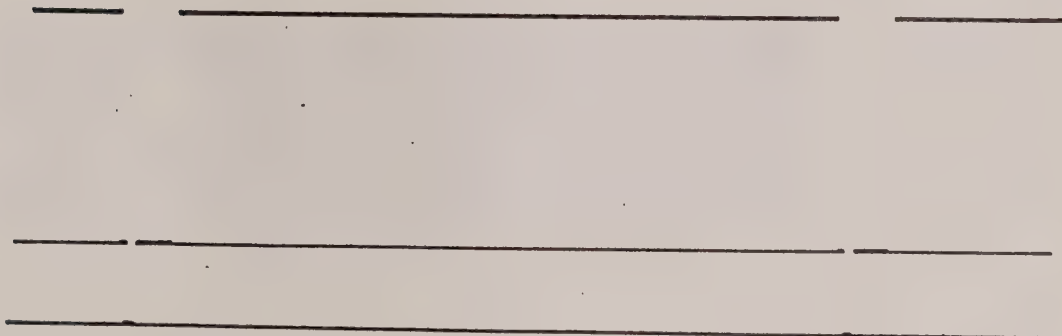
Figure 14 - Oscilloscope view of the WINDOW or V STRIPE signal waveform, Black polarity.

V STRIPE

The horizontal component of the Window signal presented for the full duration of the vertical television field will develop a V Stripe on the televised display. This will provide an approximate 40% duty cycle (APL), thus preventing the development of distortion which may be present during the lower APL of the window signal. Therefore the transient response and mid-frequency response can be evaluated without distortion due to low frequency defects.



a. Typical FLAT FIELD signal at Horizontal rate.

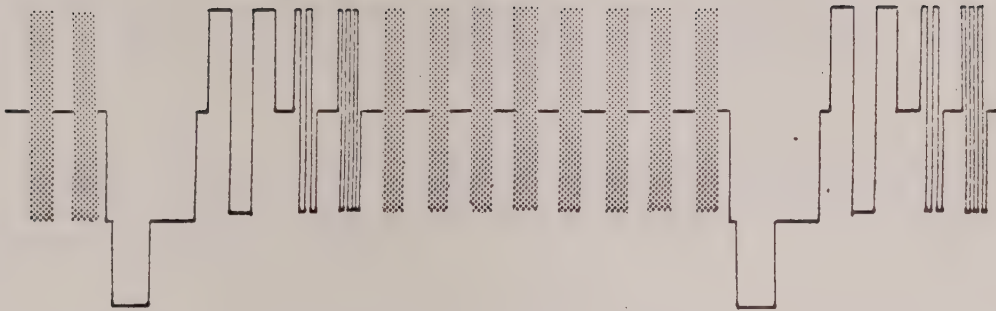


b. Typical FLAT FIELD signal at Vertical rate.

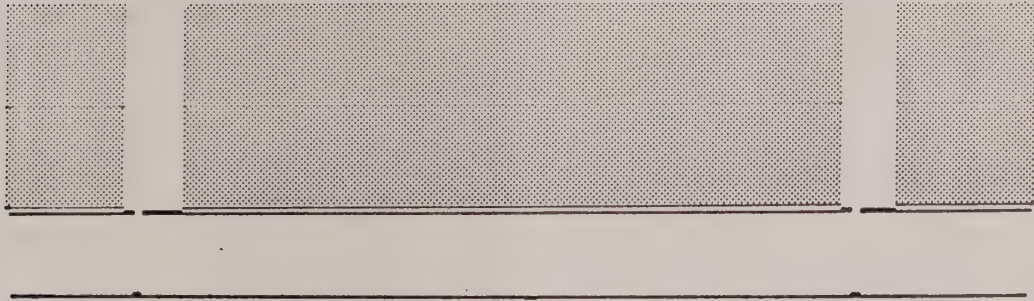
Figure 15 - Oscilloscope view of the FLAT FIELD signal waveform.

FLAT FIELD

The flat field is an all-white, uniform signal of 100% duty cycle (APL). It represents a maximum load, and the uniform display permits evaluation of undesired brightness modulation which may be introduced into the display by the display device.



a. Typical RESOLUTION Multiburst Signal at Horizontal rate.



b. Typical RESOLUTION Signal at Vertical rate.

Figure 16 - Oscilloscope display of a Typical RESOLUTION Multiburst signal waveform, Medium APL

By common practice and standards definition, television resolution is the ability of the system to produce an alternate black and white line structure. Each line, black or white, is counted (as opposed to the common "line-pair" terminology of photography). Specifications of t.v. lines are related to the vertical dimension of the aspect ratio (ratio of horizontal size to vertical size).

The test pattern for resolution is generated electronically as a square wave, providing alternate black and white images in the display. Generally, the bursts are calibrated in 100 line increments, in ascending order, as shown in Figure 16. Alternate calibration provides bursts of resolution at any one selected resolution rate, or a continuous presentation of the desired rate over the entire active raster as shown in Figure 17. Signal timing required to develop the desired "t.v. lines" at various scan rates is shown in Table II.

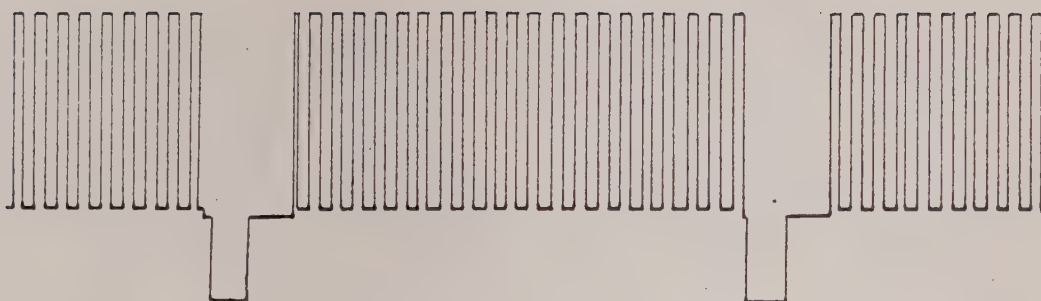
In the 4:3 aspect ratio, in which the horizontal dimension is 1 1/3 times the height, there are actually 1 1/3 times the lines displayed as stated by the specifications. For example, a specified 100 t.v. lines will actually produce 133 elements across the horizontal scanning line, alternately black and white. This signal is used primarily to test horizontal resolving capacity of the system.

a. Horizontal Resolution - Television horizontal resolution is specified as the number of lines, alternately black and white, which can be resolved in the length of scanning line equal to the height of the raster.

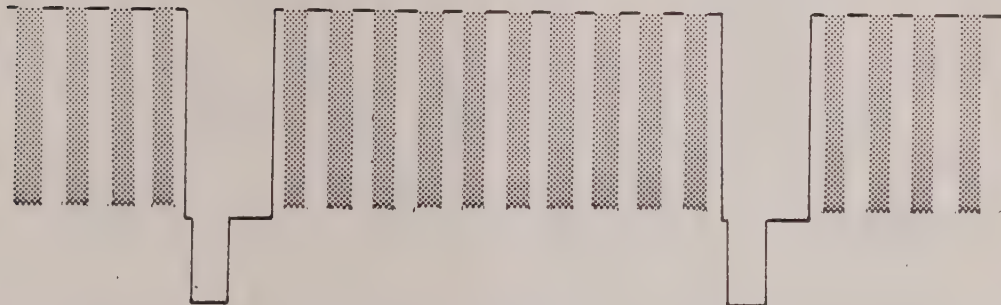
Tests of resolution usually are conducted at a 50% APL, as produced by a continuous, alternate black-and-white resolution line pattern. When a series of bursts is generated, the space between bursts is generally provided at a 50% gray level to preserve the Medium APL. Selection of either white level or black level between bursts will provide a Maximum (80%), or Minimum (20%) APL, as shown in Figure 17.

TABLE II
CCTV RESOLUTION TIMING
4x3 ASPECT RATIO

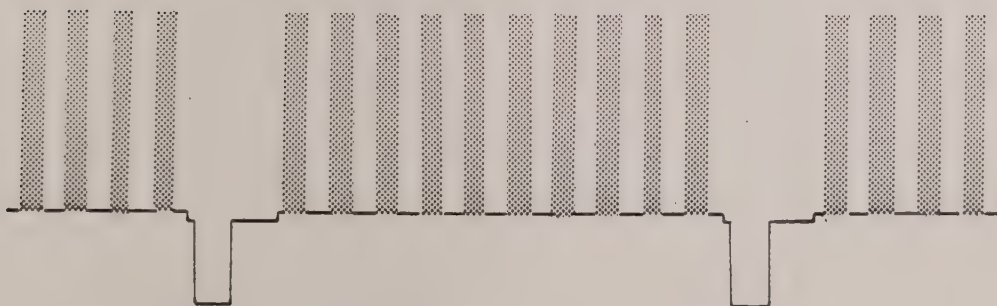
RESOLUTION -											
T.V. LINES -											
ACTUAL, H LINE											
SCAN RATE (lines)	ACTIVE H LINE (usec)	100	200	300	400	500	600	700	800	900	1000
		133	266	399	532	665	798	931	1064	1197	1333
TIME PER CYCLE (LINE PAIR) (nsec)											
525	52.0	780	390	260	195	156	130	112	97	87	78
675	42.4	638	319	213	159	128	107	91	80	71	64
729	38.7	574	287	191	144	112	96	82	72	63	57
875	31.0	455	228	152	114	92	76	65	57	51	46
945	28.3	426	213	142	107	86	71	61	54	47	43
1023	25.6	385	193	128	97	78	69	55	48	43	39
1029	25.4	380	190	127	95	76	68	54	47	42	38
1225	20.2	305	153	101	77	62	51	44	38	34	31



a. Typical RESOLUTION Signal, Continuous mode.



b. Typical RESOLUTION Signal, Burst Mode, Maximum APL.



c. Typical RESOLUTION Signal, Burst Mode, Minimum APL.

Figure 17 - Oscilloscope display of a typical RESOLUTION signal, in CONTINUOUS or BURST modes at various APL, Horizontal rate.

b. Vertical Resolution - Resolution in the vertical plane is dependent upon the number of scanning lines in the vertical raster dimension. An exacting description is complicated by the fact that "horizontal" scanning lines are not truly horizontal, but are pitched slightly by the vertical deflection which occurs during a line period. The error is slight, varying with the number of scanning lines produced in the t.v. field. In most circumstances the error is so slight that an analysis of the television scanning line will truly indicate vertical resolution.

An inspection of the Flat Field signal for sharp presentation of scanning line structure will provide an adequate prediction of vertical resolving capacity. Consideration must be given to the number of lines not displayed due to the vertical blanking interval. It is presumed that vertical resolution capability is equal to the number of ACTIVE scan lines per frame. However part of the raster may be obscured by overscan, and not useable.

For demanding tests, the scanning line number can be modified by the Kell factor as a further prediction of resolution in the actual vertical plane. This figure has been established at 0.7 for the 525-line rate, but has not been determined for other scan rates. Generally it is believed to be higher for increased numbers of scanning lines. Since the figure is derived from subjective tests, its use is not recommended.

Vertical resolution tests can be extended to provide a complete analysis of possible limiting resolution by use of scanning line profile analysis. (2)

(2) Harshbarger, John H., Test and Evaluation of Electronic Image Generation and Projection Devices, U.S. Government Technical Report AMRL-TR-65-116, Vol. I., "Evaluation Technique" (August, 1965).

CONTROLS AND ADJUSTMENTS

FRONT PANEL

- ON-OFF - Main power switch to control application of 120 v. a.c. to the unit.
- FUNCTION - Selector switch which permits the operator to choose either the BAR, DOT, H BARS, or other pattern to be developed at the output.
- LEVEL - Controls the amplitude of pattern which is presented at the video output.
- SIGNAL TYPE - Selector switch which permits the operator to select the type of output video signal desired
--Video only, Noncomposite (Video plus Blanking) or Composite (Video plus Blanking plus Sync).
- POLARITY - Switch selection of either white or black pattern to be provided at the Video Output. Does not apply to the Gray Scale, Resolution, or Flat Field signals.
- CAL/
VARIABLE - Permits selection of pattern proportion as internally CALIBRATED. Or, in the VARIABLE position, the H WIDTH and V WIDTH controls are operative.
- H WIDTH - Adjusts the width of pattern elements in the horizontal dimension of the television raster, selecting the number of elements which will be displayed in the horizontal dimension of the raster. Nominal setting of this control provides 17 bars or dots in one scanning line length. This control also adjusts horizontal width of the Window and V Stripe patterns on the raster.
- V WIDTH - Determines the width of pattern elements in the vertical dimension of the television raster, and therefore controls the number of elements which will be displayed in the Bar and Dot patterns, and vertical width of the Window pattern. (Nominal setting of this control provides 14 bars or dots in the height of the television raster).
- POSITION - Permits either FIXED position of the Window or V Stripe patterns, as set by internal control, or VARIABLE position as controlled by the H POSITION and V POSITION controls.

CONTROLS AND ADJUSTMENTS (continued)

FRONT PANEL

- H POSITION - Controls the position of the pattern on the television raster, a control particularly helpful in matching the pattern to the EIA Linearity Ball Charts used for linearity adjustment.
- V POSITION - Permits adjustment of position of the pattern in the vertical dimension of the television raster.
- RESOLUTION SELECTOR - When main function selector is in the RESOLUTION position, this switch permits selection of resolution circuit board that is in operation.
- RESOLUTION CONTENT - Operable in Variable mode only, controls resolution density presented at each step, precluding calibrated values indicated at front panel selector switch.
- RESOLUTION MODE - Presents either continuous resolution pattern of bursts as desired. Not operable in BAR or Multiburst positions. The APL adjustment operates in the Burst mode only.
- GRAY SCALE A.P.L. - Permits development of either a full raster gray scale or partial raster of pattern with variable APL capability in the remainder of the raster.
- APL (Average Picture Level) - In conjunction with the Resolution and Gray Scale patterns the Average Picture Level (signal duty cycle) can be adjusted to either the Minimum, Medium, or Maximum levels, normally adjusted internally to provide the desired duty cycle levels.

INTERNAL

Access to internal adjustments is achieved through the rear door, which extends across the left side of the unit. The door is opened by loosening two captive fasteners and then swinging the panel down to expose the circuit boards. Position for the

CONTROLS AND ADJUSTMENTS (continued)

INTERNAL (continued)

circuit boards is stamped on the individual circuit card guides. Insertion of boards into the improper slot will not cause damage, but of course the generator will not operate properly. Exercise care to insert circuit cards into the correct location, and establish that they are firmly seated into the connector.

LOWER DECK

- | | |
|---------------------|---|
| POWER
REGULATORS | - Each POWER REGULATOR Board contains a control to set the proper reference voltage levels in the generator. |
| SYNC
LEVEL | - Adjustment of the potentiometer on the SYNC/BLANKING Board varies the level of the Sync signal that is inserted on the Video Output signal. The output may be adjusted from zero to nearly 0.5 volts. |
| BLANKING
LEVEL | - The control at the lower edge of the SIGNAL OUTPUT board controls level of the blanking pedestal (setup) inserted into the composite video signal. |
| V BAR
SIZE | - The control at the lower edge of the V BAR board permits adjustment of the size (width) of V Bar element which will be generated. |
| POSITION
CONTROL | - Controls at the top and bottom of this card permit adjustment of the horizontal and vertical position on the raster for the Bar, Dot, H Bar, or V Bar patterns. |
| WIDTH
CONTROL | - Controls at the edges of this card permit adjustment of the width between elements in the horizontal and vertical planes for the Bar, Dot, H Bar, and V Bar patterns. |
| H
WINDOW | - The adjustment of the lower edge of this board fixes Window or V Stripe horizontal width while operating in the CALIBRATED mode. The control at the upper edge adjusts position of the Window or V Stripe patterns on the raster in the horizontal plane in the POSITION-VARIABLE mode. |

CONTROLS AND ADJUSTMENTS (continued)

INTERNAL (continued)

- V WINDOW - Control of the width of window pattern in the vertical plane is accomplished at the potentiometer on the lower edge of the circuit board when operating in the CALIBRATED mode. The control at the top of the window in vertical plane of the raster in the POSITION-VARIABLE mode.
- GRAY SCALE CONTROL - In the Position switch FIXED mode, the control at the lower edge of the circuit card adjusts the length of horizontal line in which gray scale will be developed.
- GRAY SCALE - Each GRAY SCALE Board contains two controls for adjustment of steps in the gray scale pattern (black and white level at the extreme ends of the scale are fixed). These controls should be adjusted for the proper linear or other gray scale characteristic desired, while observing the output signal waveform on an oscilloscope. Specific procedure for gray scale calibration is outlined in the Calibration and Maintenance section.
- APL - The control at the top of the board controls the distance from the top of the raster to which the Gray Scale Pattern will start; the control immediately under this controls the distance in which the pattern will be generated. The control at the lower edge of the board adjusts gray level which will be developed in the Medium APL position.

UPPER DECK

- RESOLUTION - Each RESOLUTION board contains a potentiometer at the top to adjust precisely the resolution line density for the particular aspect ratio and active line length in use when operating in the Calibrated mode. This adjustment should be made while observing bar width on a precisely calibrated oscilloscope, as described under "Calibration and Maintenance."

CONTROLS AND ADJUSTMENTS (continued)

INTERNAL (continued)

- DUTY CYCLE - The control at the lower edge of the MULTIBURST Board permits adjustment of the position of the bursts developed, permitting closer or further spacing of burst elements.
- D.C. LEVEL
- RESOLUTION CONTROL - The potentiometer at the top of this circuit board permits adjustment of the medium APL, varying the level of gray seen between bursts in the resolution pattern.

CALIBRATION AND MAINTENANCE

Signal Source generators operate automatically, developing an analog television signal through digital techniques. Therefore no extensive calibration is required. Signals should appear on an oscilloscope as shown in Figure 4 to 11 under OUTPUT SIGNALS.

Voltage Levels

The proper logic levels are adjusted by use of the control provided on the POWER REGULATOR Boards. These levels, +5v. and -5v., are a reference level for internal timing operations, and therefore must be carefully adjusted to the proper value while being monitored with an accurate voltmeter. Test points are provided as shown on Layout Drawing L-1006. CAUTION: These are "floating" supplies - do not ground the test points to chassis.

Resolution

The resolution line density should be calibrated periodically for exact television measurements. Calibration is stated in "t.v. lines," a term indicating "the number of television resolution lines, alternate black and white, that can be developed in a length of horizontal scanning line equal to the raster height (vertical dimension)." Therefore, for exact calibration, it is necessary to know:

- a. The active raster height as related to the active raster width (Aspect Ratio), ordinarily 3 to 4.
- b. The active horizontal television line scanning time (total time less blanking interval).

For example, the 525-line American television systems operate at a 15.75 hKz horizontal repetition rate, which yields a 63.4 usec total horizontal line time. Typically, the horizontal blanking time is 11.5 usec, providing nearly a net 52 usec active line time. Considering the aspect ratio, the horizontal line is 4/3 times the dimension of vertical raster height for a 3 to 4 aspect ratio.

Assume that calibration is to yield 300 lines. The active line length must permit development of $300 \times 4/3$ or 400 lines. It is desired to develop 300 t.v. lines in 52 usec for this example, or a line spacing of exactly .130 usec (130 nsec) per element. The control potentiometer on the board is adjusted for this condition. Each of the six resolution steps must be similarly calibrated. Refer to Table II for timing appropriate for the scan rate in use.

CALIBRATION AND MAINTENANCE (continued)

The Resolution pattern in the Signal Source 210 can be presented in Continuous or Bursts of one repetition rate over the entire t.v. raster or as a "multiburst" of various resolution densities. The multiburst content varies from a very coarse black and white reference through steps, each adjustable, from 100 to 1000 t.v. lines in 100 line steps. Each burst may be separated by white, gray, or black space as selected to aid in visual observation of the signal on the oscilloscope and of the pattern as displayed on a monitor.

Resolution Calibration Procedure

1. Observe the output signal on an oscilloscope which has a risetime capability of 10 nsec or less. Use of an oscilloscope with less capability is permitted, but observation of full modulation depth will not be possible.
2. Sync oscilloscope in External mode from the leading edge of H Drive. Expand scope sweep time as necessary to inspect detail in areas of interest. Use of magnified (expanded) sweep or delayed sweep may be of value in observation of detail in the center of the television line.
3. Select the Multiburst mode, and adjust the oscilloscope to view the first burst past the Black/White reference bars. Adjust the Duty Cycle Control (middle of Multiburst board) to cover this raster with resolution pattern as desired. Check that all 10 steps are visible on the television raster. Adjust the top control on the RESOLUTION-100 line Board for proper content, as shown in Table II.
4. Observe each burst in turn, adjusting succeeding controls on the Resolution Boards to obtain the resolution density desired in that particular burst; refer to pulse timing as outlined previously.
5. Adjust the APL (Average Picture Level) as desired by use of the potentiometer on the Resolution Control Board. This is normally adjusted to provide a 50%-of-peak level, a gray segment, between each burst for the Medium APL mode.
6. View the output signal through a complete burst series and check for uniform modulation, lack of spikes and overshoots, etc., when output is properly terminated.

NOTE: If scan rate is changed, all resolution boards must be trimmed to proper value. It is proper for the signal to "drop out" if control voltage exceeds normal levels requiring operation at a repetition rate in excess of 30 MHz. Proper operation will be restored by bringing controls back into normal range.

CALIBRATION AND MAINTENANCE (continued)

Bar, Dot, H Bar, V Bar

Proportion of the pattern for width between elements as desired should be adjusted at the Width Control board for the Calibrated mode. Position of pattern as desired is adjusted at the Position Control board for the Fixed mode. Bar and Dot position on the raster, and width between elements are adjustable from the front panel to match reference linearity charts used for camera and monitor setup in the Variable control modes. Width of the V Bar element should be adjusted to match the H Bar element size as observed on the televised display of the Bar (Crosshatch) signal.

Window

The Window pattern may be positioned on the raster as desired, but must be adjusted for size. A 20% coverage of raster area (0.414 h and 0.414 v) is recommended. This function is adjusted from internal controls on the circuit cards for the Calibrated width and Fixed position modes, using controls on the H WINDOW and V WINDOW circuit boards cards as shown on layout drawings for these boards.

Gray Scale

Gray scale linearity is controlled by potentiometers on the Gray Scale boards, and should be adjusted for a linear "stairstep" display on an oscilloscope. Range is provided to permit use of either a linear or log 10-step scale; other desired characteristics are available from the factory as options.

The successive circuit boards "add up" to develop the steps of gray scale pattern. It is necessary to start adjustment at the top step (nearest white) and work down the scale. Set up an oscilloscope view of the signal in the Full Raster mode, ascending or descending as desired, with the amplitude of the video portion of signal spanning 10 graticule divisions (nine spaces). Adjust the first step by use of the middle control on the GRAY SCALE board nearest the A.P.L. board for one division down from white level. Then adjust the control at the top of that board to set the second step down two divisions from white level. Proceed to the next GRAY SCALE board to the right, adjusting the middle control to place the third step three spaces down from white, the top control to place the fourth step four spaces down, etc.

Adjustments must be made for the position and width of gray scale stripe in the Variable A.P.L. mode. The stripe position should be set as desired by use of the control at the top of the A.P.L. board, and width of stripe set by the control immediately below the position control. Width of the stripe is recommended to be 20% of the active raster height, or nominally 3,000 usec.

CALIBRATION AND MAINTENANCE (continued)

Pedestal

Pedestal level, or level of Blanking in the video portion of the signal, is adjusted as desired by the control at the lower edge of the SIGNAL OUTPUT Board. Nominal value for setup is 0.05v at the output with a terminated line.

Sync Level

The sync portion of the signal should be adjusted as desired, nominally at 0.4v. pk. level, by use of the control at the SYNC/BLANKING board.

Risetime

Risetime and falltime may be limited by a capacitor filter on the SIGNAL OUTPUT board. This may be increased by increasing capacitor value, or decreased by lowering the value of this component or removing it completely. Nominal output without filtering will range from 10 to 20 nsec. Usually the unit is shipped with no capacitor connection to assure the sharpest possible risetime; contact the factory for details of connection if limiting is desired.

No particular maintenance procedure is required for the generator. Calibration as outlined above should be checked periodically, at 90 day intervals to assure consistent test results with the generator.

Units which are enclosed in racks or other enclosures must be provided with sufficient cooling air to assure normal ambient operating temperatures.

TROUBLESHOOTING

Should malfunction occur, fault isolation is effectively achieved by the following procedure:

1. Inspect the H Drive, V Drive, Blanking, and Sync inputs and Video Output for conformance to typical waveforms as shown in previous sections of this manual.
2. If difficulty is noted in a certain pattern, remove the modules for that function and check for proper operation at other functions, as follows:

Bar, Dot, H Bar, V Bar - H BAR and V BAR boards

Resolution - MULTIBURST, MULTIBURST CONTROL,
RESOLUTION, and RESOLUTION CONTROL boards

Window - H WINDOW and V WINDOW boards

Gray Scale - RING COUNTER, GRAY SCALE SELECT, GRAY
SCALE, A.P.L boards

The POLARITY board develops the White and Black patterns for Window, Bar, Dot, V Bar, H Bar, and V Stripe functions. Other signals, Gray Scale and Resolution, are not processed by this board.

With all of the above cards removed, a Flat Field signal should be obtained at all function settings. Difficulties associated with no video portion of signal or improper video level will originate either in the +5v. POWER REGULATOR board (+10v. buss), GRAY SCALE CONTROL board, LEVEL control (front panel), or SIGNAL OUTPUT board.

3. Difficulty in pattern synchronizing, lack of all patterns, can be traced to the SYNC/BLANKING board.
4. A deficiency in the output video, either the sync or blanking (setup) portion, can be traced to the SYNC/BLANKING or SIGNAL OUTPUT boards.
5. Improper pattern generation, inaccurate sync timing, etc., of a gross nature can be traced generally to misadjustment or failure of the POWER REGULATOR circuits.

Operation of each of these cards is discussed in detail under CIRCUIT DESCRIPTION; refer to the appropriate paragraphs after fault isolation as described above.

CIRCUIT DESCRIPTION

The Signal Source 210, CCTV TEST PATTERN GENERATOR, is a self contained instrument which develops precise reference television test signals. The signals are synthesized through modern digital techniques; all circuits are completely transistorized, composed mainly of multivibrators which employ high speed switching transistors. Power supplies are closely regulated to insure dependable, stable operation over wide variations in ambient conditions. The unit is modularized; all circuits are contained on fiberglass plug-in cards. The design is such that functions may be described by individual circuit card discussion.

The basic chassis is composed of a vertical card file (rear of unit) which contains power regulator and pattern development circuit boards. The front portion of the case contains series regulator transistors mounted on heat sinks and terminal blocks at the left side wall of the cabinet, plus a tray which contains power transformers and space for the sync generator or other accessory package.

Pattern Generation

Synchronizing information is received at the SYNC/BLANKING board where the pulses are processed to correct polarity, d.c. level, and pulse width for generation of the signals as desired. A basic horizontal gate is developed to control horizontal pattern elements, and a vertical gate is developed, equivalent in width to the vertical blanking interval, for development of vertical elements. The sync signal is processed only for addition to the output video signal, if desired to develop a Composite video signal at the output. The level of this pulse may be reduced to zero by a control on this board to develop a non-composite video signal.

A modular concept is used; circuits for development of the various individual patterns are contained on separate, removable circuit boards. The basic amplitude control and the gray scale signal, which is analog in nature, is developed by the GRAY SCALE CONTROL, GRAY SCALE, and other associated control boards. The complete analog signal is routed to the LEVEL control on the control panel to determine the amplitude of the video portion of the output signal. This signal is submitted to the SIGNAL OUTPUT board where it is mixed with other digitally formed pattern elements to develop the complete video portion of the output signal. If the gray scale waveform is not

being used, the GRAY SCALE CONTROL board produces only a d.c. level that is used to clip off digital pattern elements, acting as an amplitude, or level, control.

The digitally derived patterns with selectable polarity (Bar, Dot, H Bar, V Bar, Window, V Stripe) are routed to the POLARITY board where either white or black pattern elements are developed, as desired, then routed to the SIGNAL OUTPUT Board.

Board marking is descriptive in nature to identify which patterns are developed on the boards. Individual cards are described in the following section of this manual.

It is important to note that power regulator cards are "floating." Identical circuitry is used to develop both the +5v. and -5v. reference levels for circuit operation. Difference in polarity is achieved by selection of the grounding point, either the positive or negative POWER REGULATOR board output. Therefore care must be taken in measuring potentials at test points on these boards. It is recommended that a floating (not grounded) meter be used for monitoring these levels. The pre-regulated voltage supply on the +5v. POWER REGULATOR board is utilized as a higher supply level, nominally +10v., in the GRAY SCALE CONTROL board for generation of the amplitude reference signal.

Detailed Circuit Description

POWER REGULATORS used in the Signal Source Generator are unique in that they are "floating" supplies which, depending upon grounding, may be used as either a positive or negative source. Input voltage is submitted from the secondary of the transformer to diodes CR1 and CR2 where a basic regulated voltage of about 18 volts is developed. The center tap of the transformer is returned to the ground buss completing formation of a full wave rectifier. The basic d.c. voltage is submitted through a dropping resistor to a zener diode, CR3. This preliminary voltage controls series regulator Q1 which develops a pre-regulated +10 volt source. This higher voltage, reasonably well regulated and well filtered, acts as a secondary reference and also is used in circuitry sections which may need a fairly high voltage level. The reference +5 volts used for most of the circuitry functions must be better regulated than the higher level. Therefore, the 10 volt d.c. level is submitted through a dropping resistor to zener diode, CR-4, a temperature compensated component running at the optimum zener level, 6.3 volts. This reference level is routed through an adjustable voltage divider to one side of a "long-tailed pair" circuit. The zener voltage at Q3 develops a reference level which is submitted through the emitter to common resistor R6. The d.c. +5 level is brought into the base of Q4. Therefore, a base to emitter bias level for Q4 is established, controlling the current through load resistor R7. This in turn controls the collector voltage for Q4, and thereby feeds a controlling level to the base of Q2

to the base of a power regulator transistor mounted on the cabinet. From the emitter of the power transistor voltage is distributed throughout the unit, and is returned to the POWER REGULATOR as a reference, and for further filtering through C6. The resultant is a very precise +5v. reference level which exhibits less than 1 millivolt ripple.

The incoming V Drive, Blanking, and Sync signals are routed to the SYNC/BLANKING Board, where the pulses are processed to uniform level and risetime. The outputs from this board, separated into vertical and horizontal components, control all subsequent operations in signal development.

Each of the input signals is submitted to an isolating emitter-follower which also biases the pulse signal so that pulse tips are negative (below ground level). The emitter-follower outputs then control modified multivibrators in which the negative pulse tips lock the multivibrator into a predictable mode. A modified Schmitt trigger operation is achieved with the output being of uniform level and of sharp risetime. The outputs are then routed to appropriate distribution circuitry. The sync signal is submitted to emitter-follower Q11 where impedance is transformed and a level control is included to transmit the desired sync level to the signal output board. The blanking signal is directed to a d.c. controllable on-off stage, Q7, which provides blanking selection in certain instruments that feature front panel control of composite or non-composite video signal selection. The vertical circuit, Q2 and Q3, operates somewhat differently than others previously described. The Schmitt trigger pulse as submitted through diode CR-1 locks operation of the bistable in one direction. When the vertical drive pulse ends, diode CR-1 becomes non-conductive but there is no stimulus to cause the multivibrator to change state. Therefore, it remains at the triggered level until a pulse is submitted from the blanking bistable via C4 at the end of the vertical blanking interval. Thus the V Drive signal interval is extended to the length of the vertical blanking interval to prohibit pattern generation through the blanking time.

All patterns developed by the sequences described above are routed to the SIGNAL OUTPUT circuit board for development of the composite video signal. Patterns are introduced to a common load resistor, R1. The blanking signal is introduced to this resistor via Q1 to provide an appropriate zero signal level through the horizontal and vertical blanking periods. The positive value of signal is controlled by the clipper type gain control formed by transistors Q2 and Q3. The level from the front panel control,

either a d.c. steady state level or a gray scale signal if that function is selected, forms, via Q2, a control voltage level that prevents excursion past a predictable point at transistor Q3. Thus, more positive signal excursions are effectively clipped, providing a very concise maximum signal level control. The processed signal is submitted to an isolating emitter follower Q5. The sync and blanking signals as processed in the SYNC/BLANKING board also are submitted to isolating emitter followers on the circuit board. The three signals (video, blanking, and sync) are mixed via resistors R8, R13, and R14 to develop the composite video output. The completed signal is submitted to transistor Q7 which transforms the signal to a proper impedance for output line driving through source terminating resistor R17 and through capacitor C1. The signal is then routed to the control panel and the rear connector panel for utilization.

The POLARITY board contains circuitry to develop signals of either polarity but which are identical in all other respects. Signals are developed from the various function cards at the common load resistor R13. These signals are used to trigger bistable multivibrator Q3, Q4 to develop the required opposite polarities of pattern. Bistable outputs are diode connected, by CR-1 and CR-2 to selector stages Q1 and Q2. Depending upon whether control voltage is applied to R4 or R5, only one output transistor (Q1 or Q2) can be biased "on" at a time. The collectors of these two transistors are tied together at output load resistor R1. From this point signals are routed to the SIGNAL OUTPUT board for final processing.

Horizontal elements of the H Bar, V Bar, Bar, and Dot patterns are developed in the H BAR board. This board contains an adjustable monostable multivibrator Q8, Q11, which determines the width between lines in the vertical dimension of the raster. At the end of the monostable period, a gating condition exists which permits triggering of bistable multivibrator Q3, Q4, to the "on" state for one horizontal line period. At the end of this line the monostable operation is again initiated, prohibiting pattern generation for the duration of the monostable period. During the vertical blanking interval the monostable circuit is clamped to a control level by a clamp circuit which employs the field effect transistor Q12 operating in the enhancement mode. The clamp level, controllable, is connected to the base of Q8 which determines position (phase) of the pattern on the raster. Therefore, operation is locked positively to the vertical and horizontal pattern elements.

The V BAR board controls development of vertical elements in the test patterns. This board contains an astable multivibrator Q1, Q4 which runs freely during the active line time. Each cycle

develops a trigger for a monostable multivibrator Q7, Q8 which develops the precise, sharp pulse required to produce a fine line or dot at all scanning rates. During the horizontal and vertical blanking intervals the astable multivibrator is clamped to a control voltage which establishes the position (phase) of the pattern in the horizontal dimension of the raster. The clamp circuit incorporates a field effect transistor (Q5) operating in the enhancement mode to connect the control level to the base of Q4 during the blanking interval. The board also contains auxiliary logic and mixing circuitry to form the desired combinations of patterns.

The Window pattern is developed with reference to the top and the left edge of the television raster. Basically, generation is accomplished by two H and two V monostable multivibrators; the first one times spacing from the top or left edge to the point at which pattern is developed, and the second establishes the time through which the pattern will be generated. The appropriate circuits, including mixers, are placed on the H WINDOW and V WINDOW Boards. The Window boards are similar except for the routing of input triggers. The vertical window merely derives a trigger from the input leading edge of the V Drive signal as submitted through diode CR-5. In the H WINDOW Board a trigger spike is developed from the input horizontal gate through differentiating capacitor, C-1. The spikes are submitted to a bias network and subsequently through diode CR-1 to the monostable multivibrator. However, horizontal triggers should be developed only through the vertical window period. Therefore, the V Window input signal is submitted to the bias divider, effectively forming a mixing circuit with the first stage of the H WINDOW Board in the output stage of the V WINDOW boards. Thus triggers are effectively deleted except during the V Window period. In each case, multivibrators employed feature a constant current charging network to provide great latitude in control range. Note also that a calibrated control is provided on each of these boards for use if desired. In other instances control may be provided from the front panel in which case the calibrated controls are not employed.

The gray scale signal is developed by the GRAY SCALE CONTROL and GRAY SCALE boards plus other supporting circuitry. The input controlling signal is submitted to the GRAY SCALE CONTROL board through a bias emitter follower control stage, Q1, which in turn controls an astable multivibrator which develops the rate at which bars will be developed. The time interval of this constant current-charging multivibrator is controlled by potentiometer R-18, or in certain cases may be controlled from the front control panel. Triggers developed by this astable multivibrator are used to control an integrated circuit ring counter which actually forms the gray scale waveform. Triggers are submitted to a set-reset flip-flop which develops a prime pulse to initiate ring counter sequencing.

This flip-flop is so triggered to cycle only at the start of a horizontal line as controlled by triggers developed by capacitors C-5 and C-6. Additionally, a toggle pulse is developed at Q7 to control ring counter operation. A reset pulse developed by Q6 returns the ring counter to an initial state at the end of the television line to prepare for recycling on the next line. An appropriately low voltage, 3.6 volts, is prepared for the ring counter by the dropping circuit as formed by diode CR-7 and associated components. Finally, the gray scale waveform as developed by the stepping integrated circuit ring counter of the GRAY SCALE Boards is submitted to isolation stage Q10. This signal is submitted to an isolation stage, Q9, which sets the proper positive excursion. The companion transistor, Q8, sets the minimum negative excursion the signal will experience. The processed resultant signal is submitted out of the board to the gain control potentiometer at the front panel and subsequently to the SIGNAL OUTPUT Board.

Development of the various steps in the gray scale is controlled by the integrated circuits of the RING COUNTER board which "steps off" the basic sequence in which other operations are conducted. This board contains a twelve section ring counter composed of J-K flip-flop integrated circuit stages. Each stage develops a positive output pulse, in serial form, for step control.

The gray scale steps are developed by the GRAY SCALE Boards, each board developing two steps in identical upper and lower circuit sections. Each circuit section is composed of two integrated circuit R-S flip-flops, one for each polarity (ascending or descending) of signal. For development of the ascending scale, all sections are energized initially, developing the lowest step. Then each section is turned off, in turn, to develop progressively higher steps. For the descending scale the opposite operation is conducted, turning on each section in turn until the lowest step is reached, at which point all are turned off simultaneously. The flip-flop outputs are directed to isolating stages, Q1 and Q2. Control waveforms are routed to Q3, an inversion stage, and then to Q4, the final waveform control stage.

The black flags at the extremes of the gray scale are developed in the GRAY SCALE SELECT Board, in stages Q1 and Q2, by ring counter output pulses. This board also contains power supplies and pulse output stages, Q3-Q6, for driving the R-S flip-flop stages on the various GRAY SCALE Boards. The driver section for the ascending scale also contains a two-stage ring counter, Z1 and Z2, for development of a sequence start pulse in the ascending mode.

The various APL levels are generated by gating off the Gray Scale pattern except for a short duration; reference levels of black, gray or white are generated at all other times. The

timing is controlled by two monostable multivibrators which control a bistable multivibrator which locks timing to the H line rate; these functions are performed on the APL board.

The position of the gray scale stripe from the top of the raster is developed by multivibrator Q5-Q6 whose cycle rate is determined by constant current control transistor Q1 and potentiometer R13. The width of the stripe is developed similarly by monostable Q3-Q4, as controlled by R5. The pulse developed by Q3-Q4 must be locked by bistable multivibrator Q9-Q10 to the horizontal line rate to prevent a drift or visible "run through" of the strip of gray scale as displayed. Horizontal rate triggers are submitted through diodes CR-3 and CR-4. The bistable is started by the +H Gate signal. These pulses are deleted by the diode gate CR-5, CR-6 until the strip monostable operates, permitting transistor Q4 to not saturate and permit triggers to pass through the gate to C7.

When the gray scale is not being developed, transistors Q7 and Q8 develop the gray or black levels, as selected by application of control voltage at either R32 or R39. When gray scale is to be generated, transistor Q11 acts as a voltage regulator. The base of Q11 is controlled by Q9, providing voltage to the GRAY SCALE and GRAY SCALE SELECT boards.

The output patterns may be presented in either a calibrated or variable mode as determined by d.c. voltage switching at the front panel. The proper control range selection is determined in the POSITION/WIDTH CONTROL circuit board. The calibrated pattern may be adjusted by use of internal control on the various circuit boards; the patterns are adjusted as desired for use with any particular scanning rate, and remain so fixed thereafter regardless of front panel settings. By switching on the "variable" mode, the proportion or position of pattern may be altered by adjustment of the H Width, V Width, H Position, or V Position controls at the front panels.

The POSITION/WIDTH CONTROL circuit board contains five identical sections for pattern manipulation. Basically the circuitry selects whichever voltage is higher, either calibrated or variable. When one mode is being used, voltage is removed from the other, permitting that control buss to "leak off" to ground. Control voltage is routed through a control transistor, PNP, so selected as to not provide voltage breakdown under 15 volt supply differential. The signal at the emitter of this transistor is a replica of the base voltage plus the emitter to base constant voltage rise. The signal is then submitted to a companion NPN transistor, again an emitter follower, which reflects the voltage submitted to its base less a base to emitter voltage drop. Therefore, the output voltage exactly equals the input due to the different polarity voltage drop in the two transistors. The

output emitter followers are connected in common, providing at the output that supply which is higher. The unused supply is reverse-biased and therefore inoperative. This board also contains calibration adjustments for the H Bar and V Bar patterns.

Development of the various Resolution patterns involves the interrelated action of the RESOLUTION, RESOLUTION CONTROL, and MULTIBURST Boards. Basically the resolution pattern is the alternate black and white video developed by the output of an astable multivibrator; one RESOLUTION board is provided for each burst rate, each selected to produce the desired signal. Additional control circuitry is included on these boards to control generation of the exact signal format desired. The MULTIBURST board develops the control functions which are distributed to these control components, and the RESOLUTION CONTROL board performs other auxiliary functions, particularly development of the gray level between bursts.

The MULTIBURST board contains a toggle multivibrator, Q2, Q3 which is synchronized to the horizontal blanking by clamp circuit Q1 and CR-2. Pulses from this controlled astable will control the width of resolution signal bursts and space between bursts. Repetition rate is adjustable by R10 and constant current transistors Q6, Q7 to permit multiburst development within the active scan line time for the particular scan rate in use. This Duty Cycle is directed to the various RESOLUTION boards by emitter follower Q4. If resolution bursts are to be developed, the astable operates in normal fashion, being clamped to the input H-rate control at CR-2 during the H blanking interval. For generation of a Continuous pattern, voltage is removed from half of the toggle astable, Q3. Therefore only the control waveform, identical to Blanking, is developed at the collector of Q2 due to clamp action of CR-2.

Development of the Multiburst signal requires that each RESOLUTION board operate in proper sequence. An integrated circuit ring counter is used for this control. The basic signals and preliminary stages for this counter are located on the MULTIBURST board. Toggle and reset signals are developed by emitter followers Q8 and Q9 respectively. The ring counter is reset at the end of every t.v. line to assure a proper start for each horizontal line regardless of the circuit condition at the end of the previous line. Also a reduced voltage, +3.6v., is developed by dropping diodes CR-7 and CR-8 for ring counter operation. Set-Reset flip-flop Z1 develops an initial prime pulse to command the first stage of the ring counter, Z2, to operate. This stage controls development of the black-white reference bar at the start of the Multiburst array, through Q10 which controls production of the basic toggle waveform by Q11. Stage 2 also generates an Inhibit pulse (transistor Q5) to prevent operation of RESOLUTION boards during production of the reference signal.

All RESOLUTION boards are identical except for component values (C2, C3) which are selected to provide the desired repetition rate. Signals are developed by astable multivibrator Q4, Q7 and are routed out by isolation stage Q8 to the signal buss. The astable is controlled via clamp diode CR-2 and emitter follower Q3. Whenever Q3 develops a signal below ground level, CR-2 conducts and the base of Q4 is locked in the "off" state, forcing the astable to remain inoperative. When Q3 develops a higher level of voltage, CR-2 is non conducting, effectively isolating the control stage and permitting Q4 to operate normally.

Control of the astable Q4, Q7 is obtained by stages Q1 and Q2. The duty cycle of signal development is established by the signal from the MULTIBURST circuits as directed through R2 to Q1. In turn, load resistor R4 will control output level of emitter follower Q3 through bias network R7, R8. When Q1 saturates due to a "high" condition of the input duty cycle signal, a low level is developed at the emitter of Q3, clamping the astable. When Q1 is biased "off", the astable is operative.

Additional control stages are provided to load resistor R4. The integrated circuit Z1, a J-K flip flop, is a part of the ring counter to develop the Multiburst signal sequence. Saturation of transistor Q2 also clamps the astable inoperative. At the proper time Q2 is turned "off", and control stage Q1 then permits the astable to develop a burst. Control transistor Q11 is used to prohibit operation of the astable during the initial cycle of ring counter operation. This control is required due only to the inherent nature of the ring counter waveform.

It is necessary to operate the RESOLUTION board astable multivibrator in either a Calibrated or Variable mode. The Calibrated level is developed on each individual Resolution Board. The Variable control, developed at the front panel, is routed to a companion emitter follower which is connected to a load resistor, R17, which is also connected to the emitter of control Q12. The emitter which is carrying the higher voltage will duplicate the voltage setting at R17, and the section which has voltage removed is back-biased by the emitter to base diode.

The RESOLUTION CONTROL board contains circuits auxiliary to operation of the MULTIBURST and RESOLUTION boards. Stages Q1 and Q11 develop the Variable control voltage for front panel control of repetition rates in the RESOLUTION board multivibrators. Stage Q7 generates the level of gray which will be presented between bursts; stage Q13 generates black level between bursts. These stages are controlled by transistors Q3, Q4, Q5, and Q6 as dictated by inputs from the MULTIBURST board (Q6) the ring counter (Q3, Q4)

and voltage selection (CR-2, CR-3, Q5.) Pulses for operation of the inhibit function on each individual RESOLUTION board are developed by driver stage Q2.

The MULTIBURST CONTROL board contains the final stage of the Multiburst ring counter to terminate sequence. The ring counter J-K flip flop develops a toggle for the second stage. This flip flop generates an output that saturates transistor Q1 after the multiburst sequence is complete, stopping development of the duty cycle pulses in the MULTIBURST board.

The operations described above are conducted in the sequence shown on the accompanying Block Diagram. A complete, detailed schematic of individual circuit boards is included in the following pages.

SIGNAL SOURCE 210
CCTV TEST PATTERN GENERATOR
Schematic and Layout Drawing Index

<u>No.</u>	<u>Description</u>
S-0206	Function Diagram - Signal Source 210
PL-1010	Electrical Parts List Cover Sheet
S-0122	Power Regulator Board
L-1006	Power Regulator Board
S-0121	Sync/Blanking Board
L-1009	Sync/Blanking Board
S-0229	Signal Output Board
L-1077	Signal Output Board
S-0131	Polarity Board
L-1013	Polarity Board
S-0171	H Bar Board
L-1039	H Bar Board
S-0170	V Bar Board
L-1040	V Bar Board
S-0205	Position/Width Control Board
L-1055	Position/Width Control Board
S-0186	H Window Board
L-1038	H Window Board
S-0130	V Window Board
L-1048	V Window Board
S-0124	Gray Scale Control Board
L-1053	Gray Scale Control Board
S-0219	Ring Counter Board
L-1063	Ring Counter Board
S-0214	Gray Scale Select Board
L-1067	Gray Scale Select Board
S-0215	Gray Scale Board
L-1066	Gray Scale Board
S-0220	APL Board
L-1070	APL Board
S-0213	Resolution Control Board
L-1068	Resolution Control Board
S-0126	Resolution Board
L-1008	Resolution Board
S-0127	Multiburst Board
L-1007	Multiburst Board
S-0284	Multiburst Control Board
L-1123	Multiburst Control Board
S-0207	Control Panel Signal Source 210
S-0108	Chassis Wiring

PARTS LIST

Electrical Parts List Cover Sheet

RESISTORS - Unless otherwise noted, 1/2w. 10% IRC-GBT or equivalent.

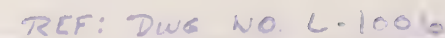
POTENTIOMETERS- (Board Mounted) Bourns E-Z Trim Type 3067-S. Value as noted.

CAPACITORS - a. 1000 pf and below - Dipped Mica, CDE Type CD15-, ARCO Type DM-15-. Value as Noted, $\pm 5\%$.
b. .001 uf to 0.1 uf - Wrapped Mylar, CDE Type WMF, 100v. $\pm 10\%$.
c. 0.1 uf to 5 uf - Solid Tantalum, Kemet Series C - Polarized, $\pm 10\%$, 15v. or higher voltage rating.
d. 5 uf to 100 uf - subminiature electrolytic, Sprague TE (30D) -10% +150%. Value and rating as noted.
e. Above 100 uf - Electrolytic, Polarized, CDE Type BR, "Blue Beaver."

SEMICONDUCTORS- Per JEDEC Number 1N--, 2N--, etc.

CIRCUIT BOARDS- Vector Type 838A.

BOARD PINS - USECO No. 2510B, Keystone No. 1575-2



POWER REGULATOR

NAME	DATE
INSBORNE	3-24-67

GRD	DATE
3-25-67	

2-2-60 S-0122

REF. C-100% complete

S-0122

11/21/70
JH

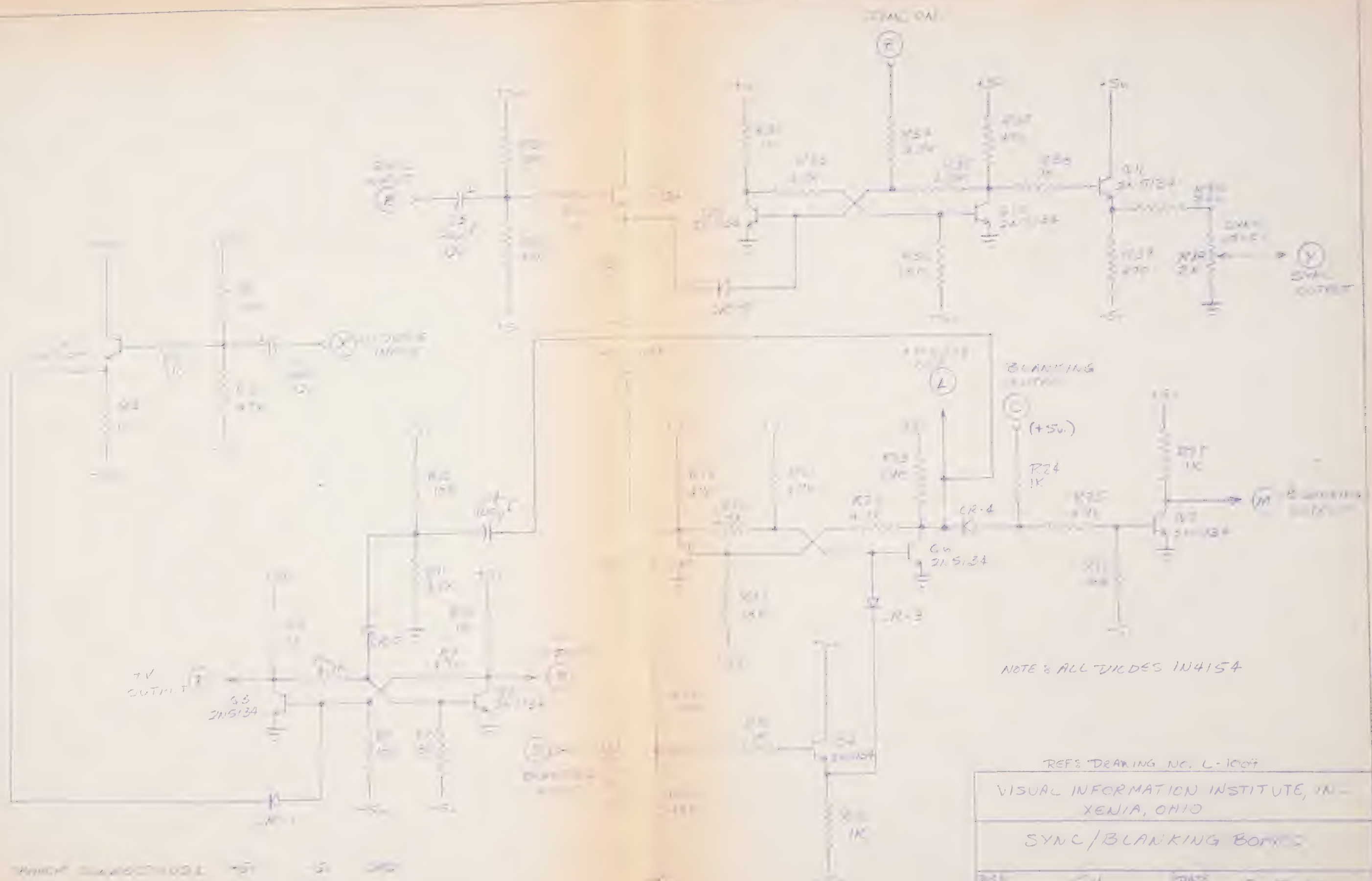
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REF. SCHEMATIC 5-0122

INSULATED WIRE, #24 STRANDED

47 | TERMINALS



8/7/68

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MATERIAL LIST

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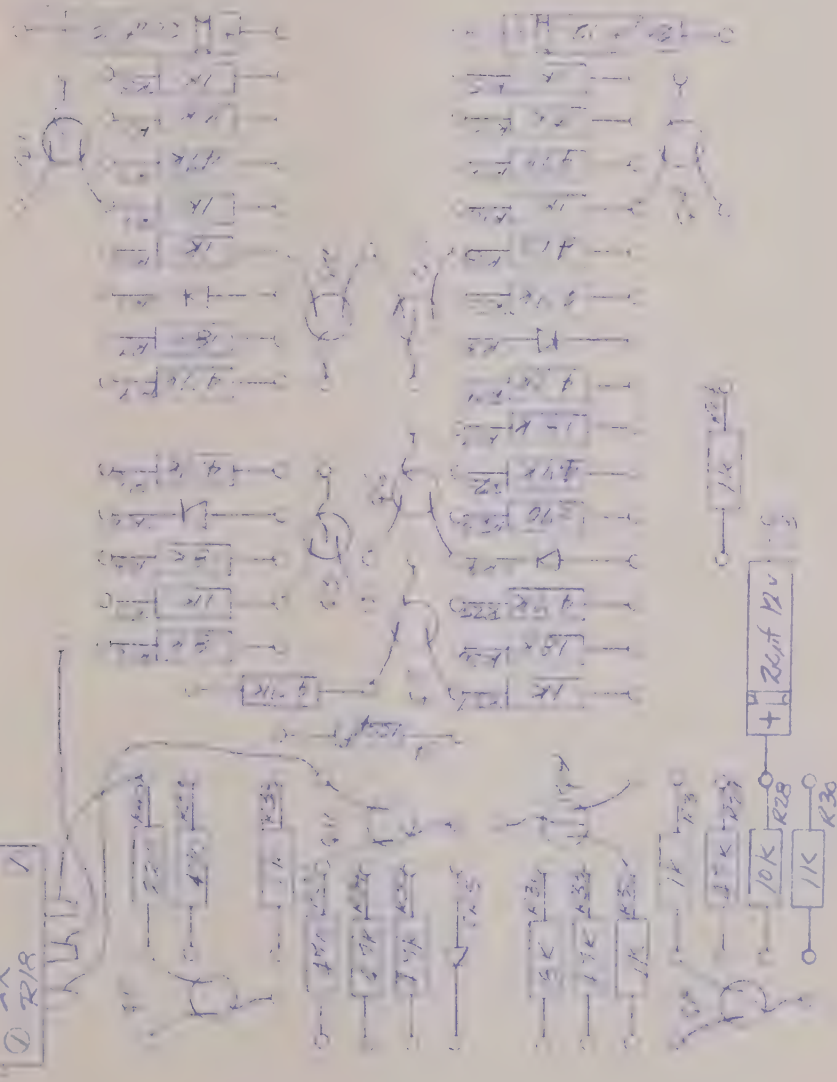
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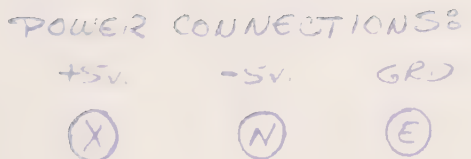
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31/10/12

3147

INSULATED WIRE, #24 STRANDED





REF ID: A6 L-177	
VISUAL INFORMATION INSTITUTE, INC XENIA, OHIO	
SIGNAL OUTPUT B (FAST RISE)	
SEN ☒	DATE 6-20-69
REC ☒	TIME 6:20-69
	DWG NO
REV 12-22-69	S-0229

SIGNAL OUTPUT B (FAST RISE)

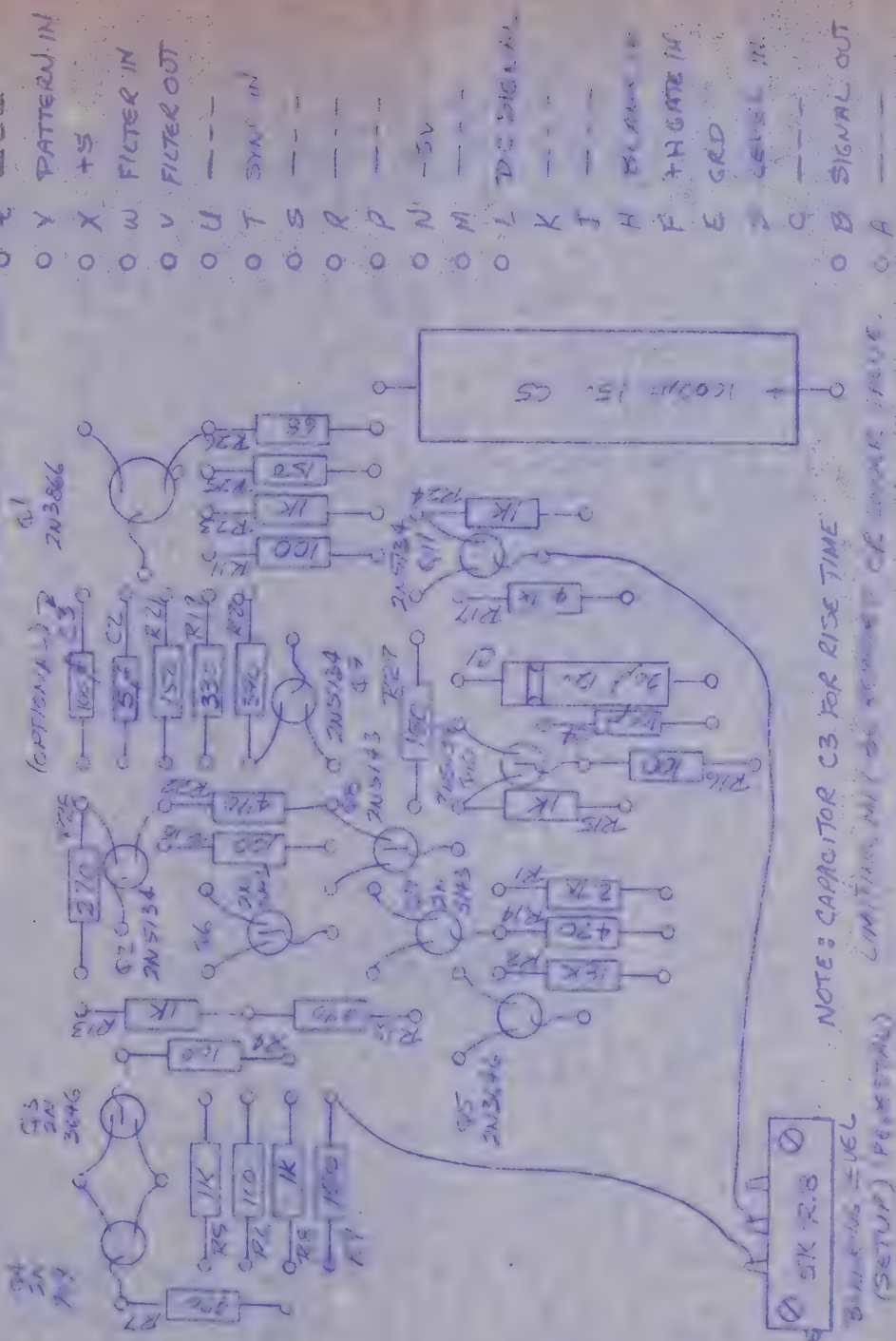
4/7/77

INTERNAL LIST

QTY	DESCRIPTION
1	2N3946
4	2N5134
3	2N5133
2	2N3946
1	2N107
1	2N
5	1K
6	100
2	4.7K
1	150
1	7.7K
1	10K
3	100
1	10
1	390
3	470
1	50
1	200
1	50
2	100
1	2N5134
1	2N5133
50	TERMINALS

4-1077

REF: SCHEMATIC S-0229

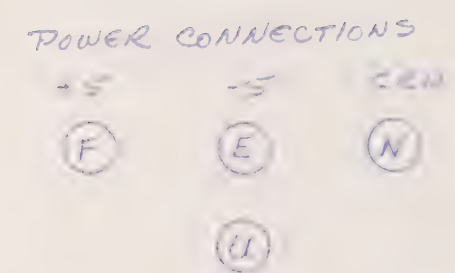


NOTE: CAPACITOR C3 FOR RISE TIME

LIMITING RISE TIME OF SIGNAL WAVE. (SETUP) (PULSE)

INSULATED WIRE, 24 STRANDED

- Y PATTERN IN
- X +S
- W FILTER IN
- V FILTER OUT
- U
- T SYNC IN
- S
- R
- P
- N -5V
- M
- L DC SIGNAL
- K
- J
- H BLANK
- F +H GATE IN
- E GND
- D LEVEL IN
- C
- B SIGNAL OUT
- A



DATE	11-11-69
TIME	11-11-68
FILE NO.	S-0131

POLARITY BOARD

11/12/68

MATERIAL LIST

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2	1N4154

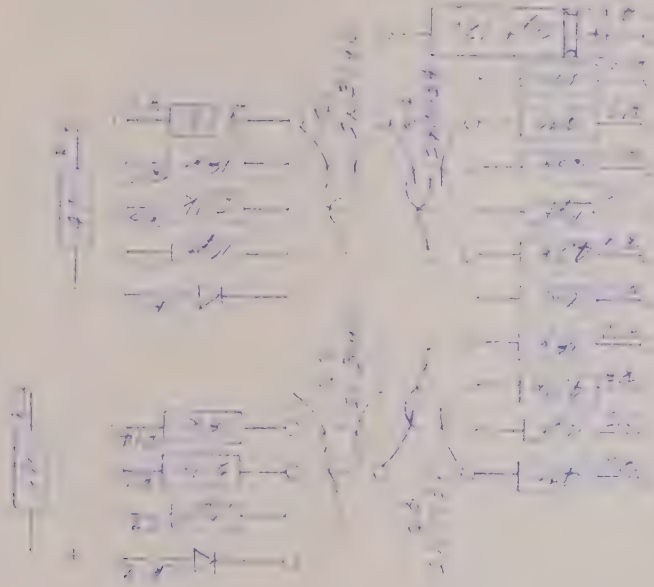
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3	16K
1	10K
2	2.2K
2	1.5

1	20pf, 12v.
4	10pf

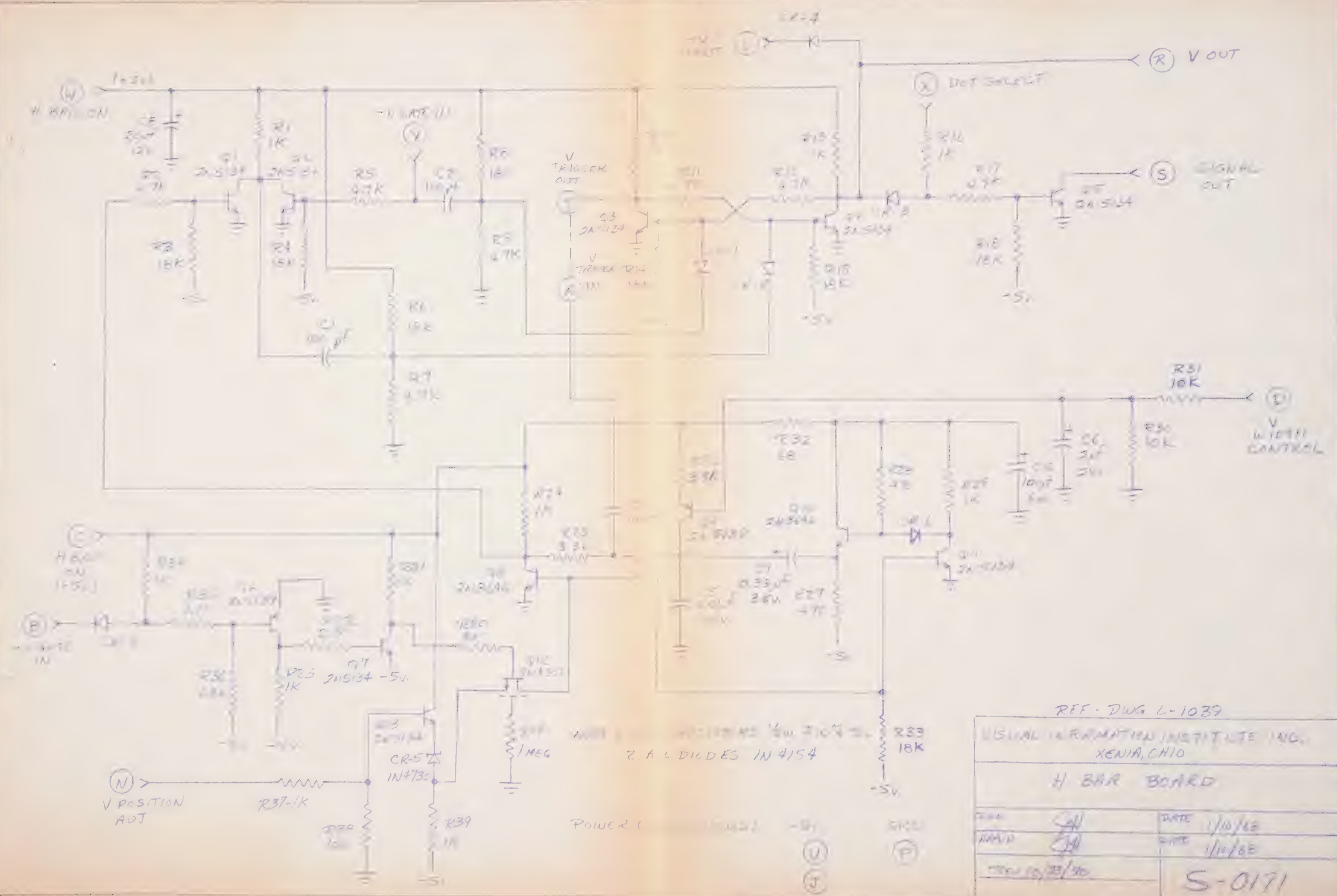
52 TERMINALS

DWG NO. L-1013

REF: SCHEMATIC S-01310



Z	
Y	
X	- SELECT
W	+ SELECT
V	
U	
T	
S	
R	
P	
N	
M	
L	
K	
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H	
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E	
D	
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REF. DWG L-1039	
USUAL INFORMATION INSTITUTE INC.	
XENIA, OHIO	
H BAR BOARD	
DATE	1/10/65
APP'D	1/11/65
TESTED	1/12/65
S-0171	

11/21/70

REF. SCHEMATIC S-0191



NOTED OTHERWISE

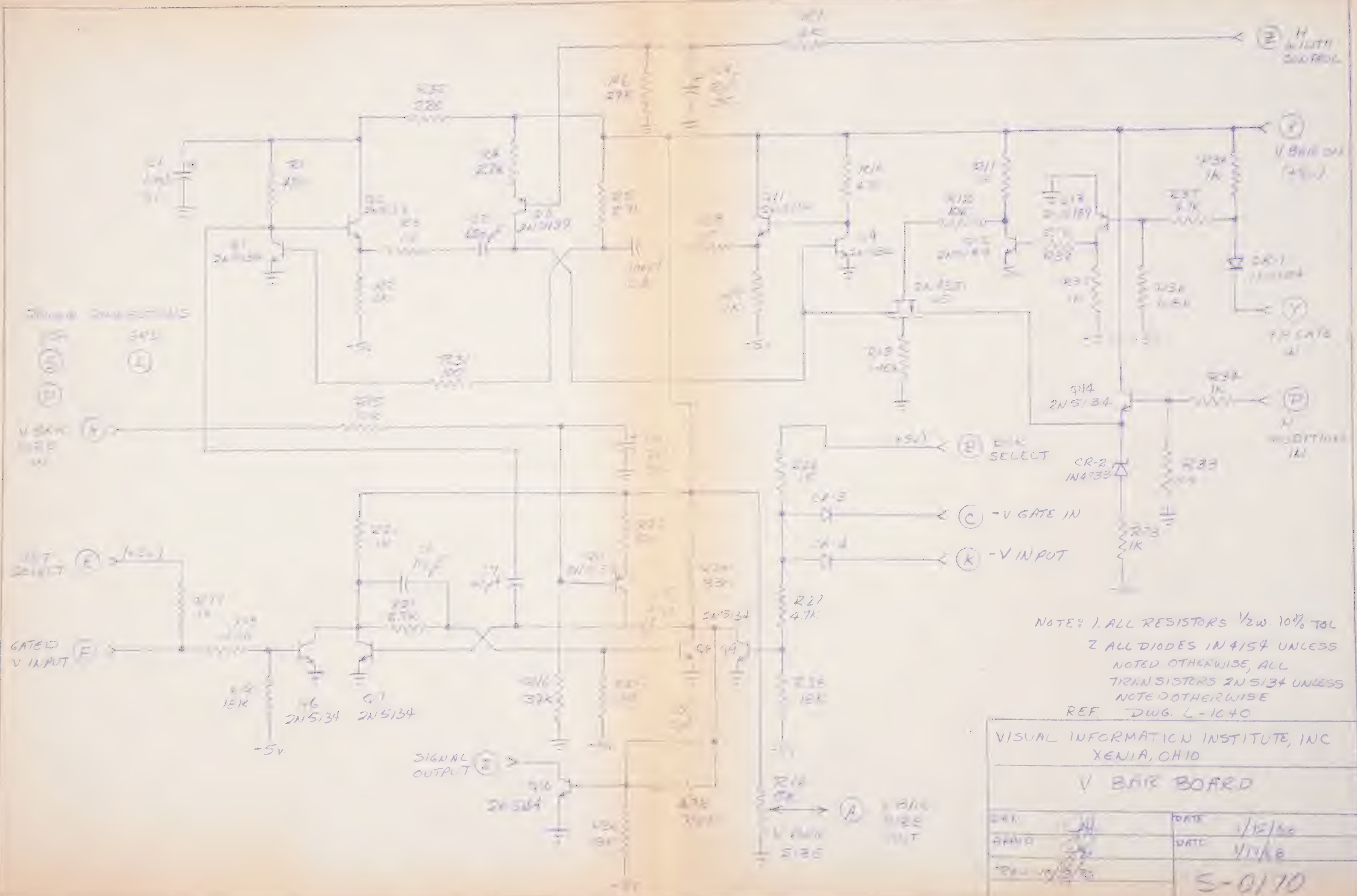
132- TERMINALS

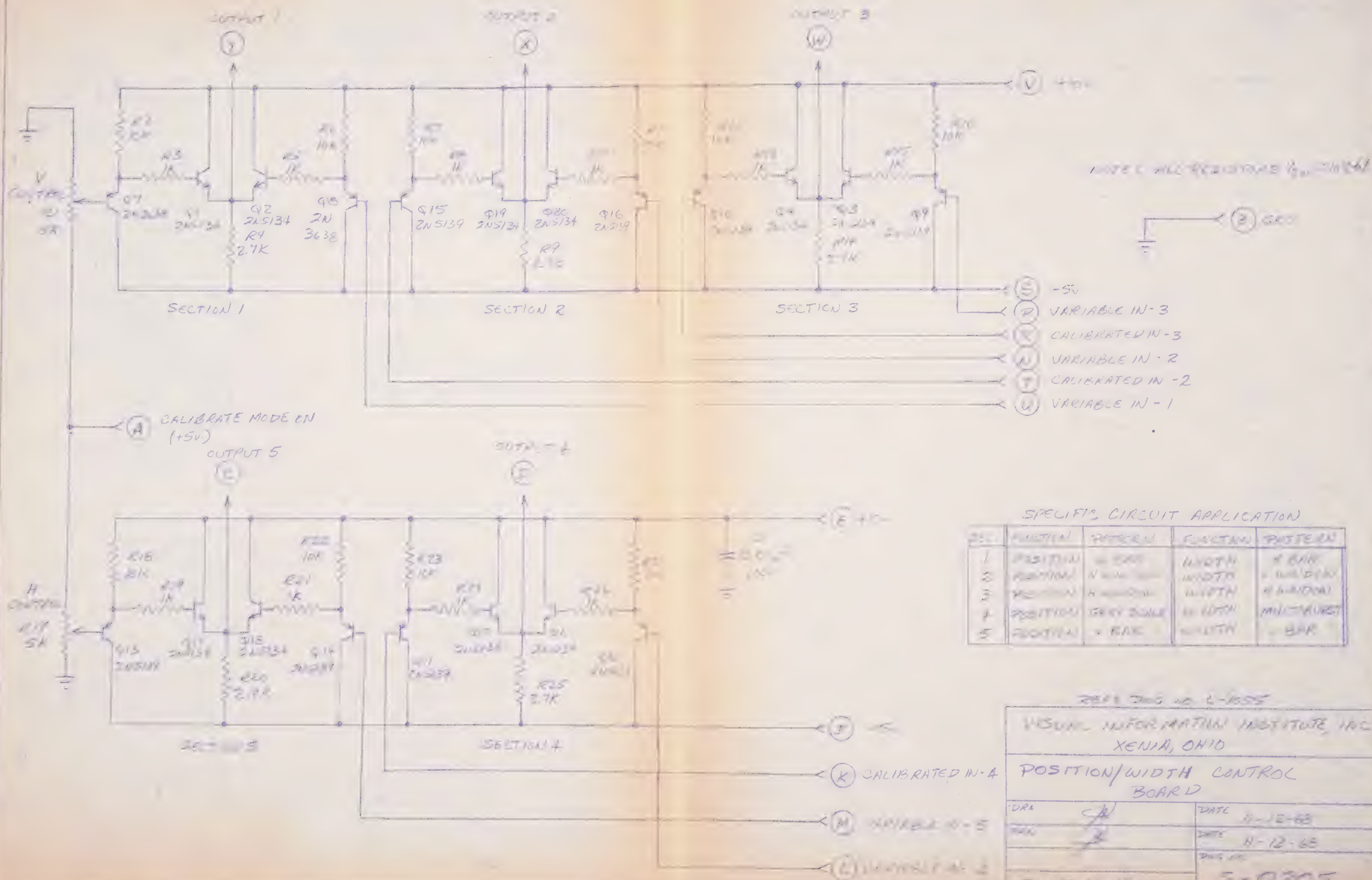
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0.22 μ f, 35v.

0.23 μ l, 35v.

100 f.

 $\text{Zn}^{2+} + 12\text{v.}$

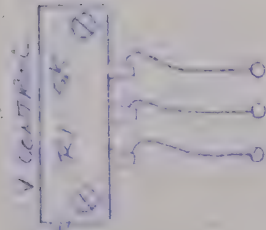




POSITION/ WIDTH CONTROL

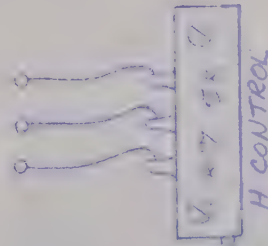
4/6/71

WATERLOO
S-0205



WATERLOO
S-0205

10 10K
1 100

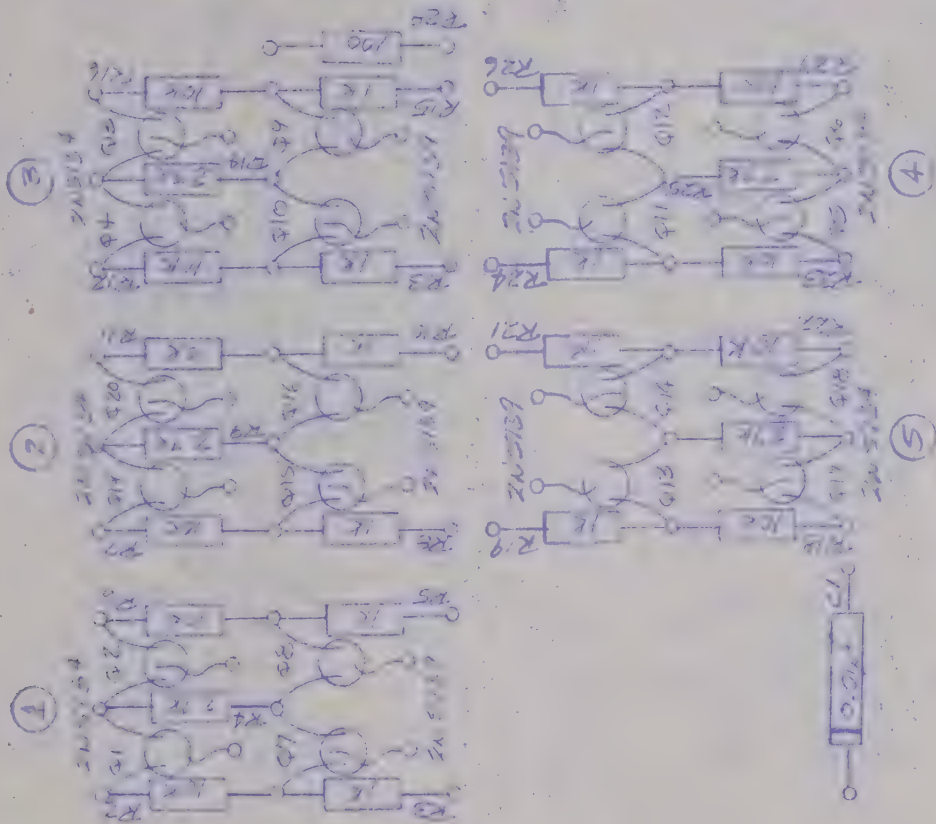


75 | TERMINALS

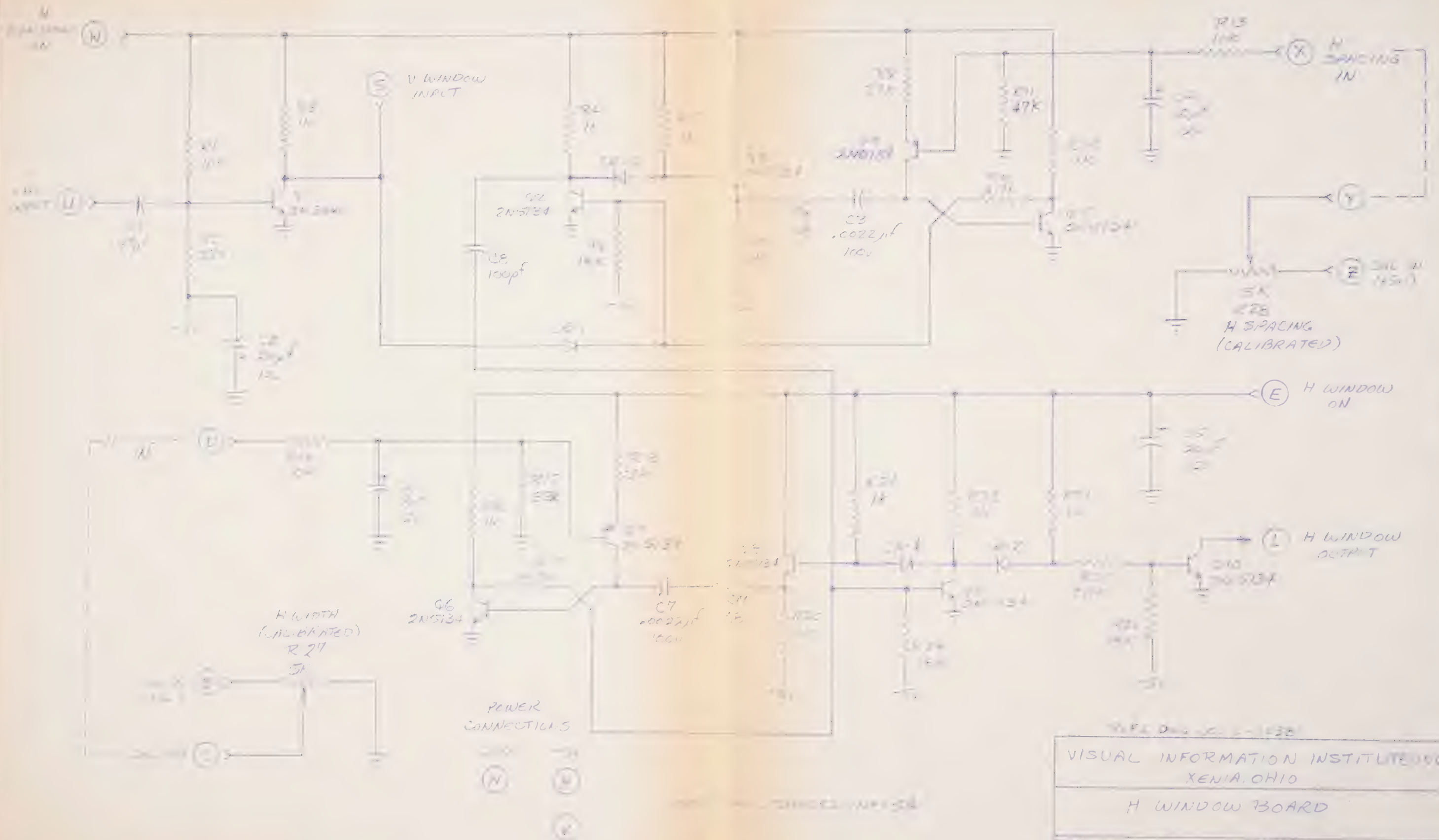
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DWG. NO. L-1055

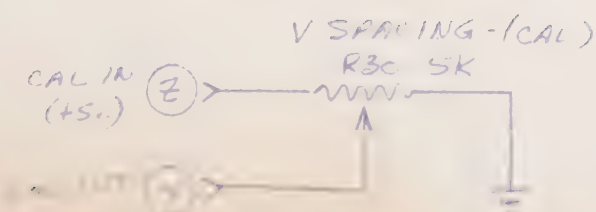
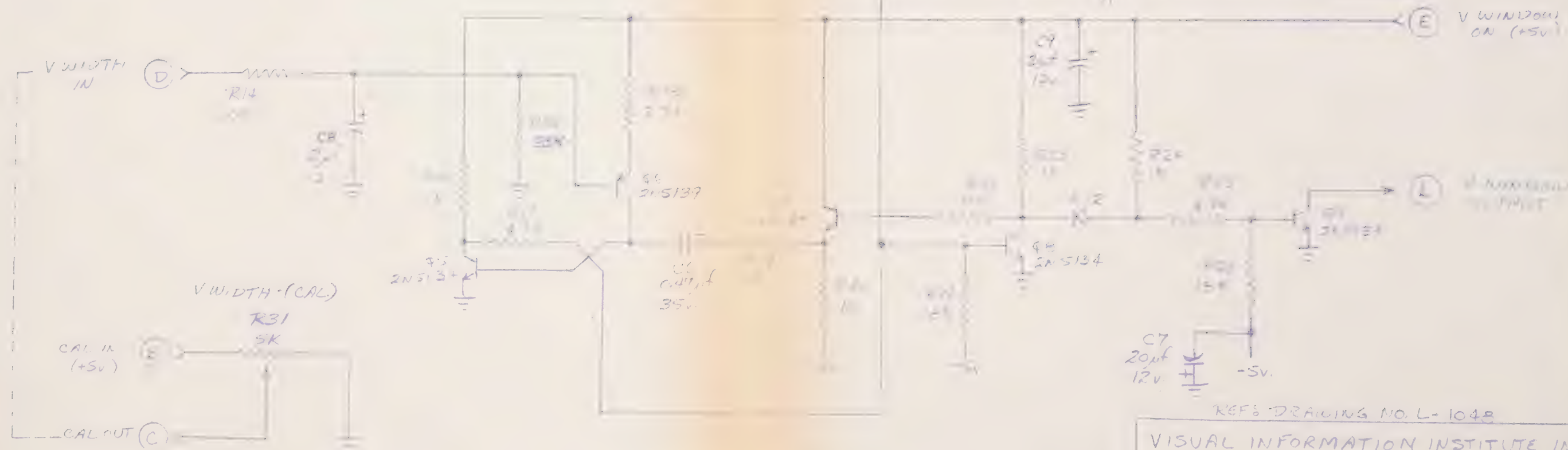
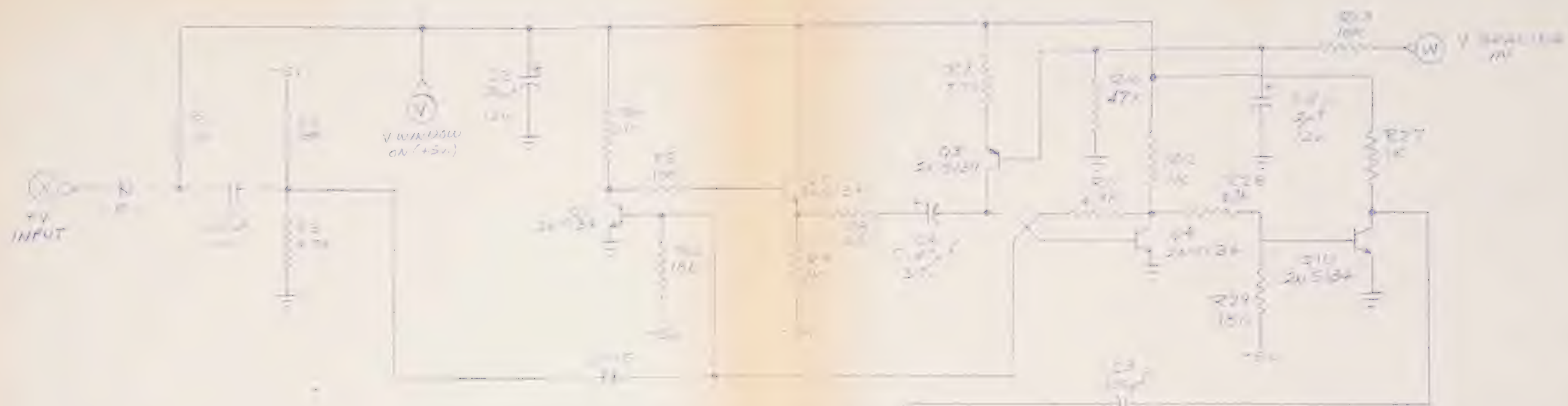
REF: SCHEMATIC NO. S-0205



O Z GRD
 O Y 30V
 O X 30V
 O W 30V
 O V +10V
 O U 30V
 O T 30V
 O S -5V
 O R 30V
 O Q 30V
 O P 30V
 O M SEC.5 IN-VAR
 O L SEC.4 IN-VAR
 O K SEC.4 IN-CAL
 O J -5V
 O H ---
 O F ---
 O E +10V
 O C SEC.5 OUT
 O B ---
 O A CAL. OUT



VISUAL INFORMATION INSTITUTE	
XENIA, OHIO	
H WINDOW BOARD	
DATE	3-6-63
BY	5-5-63
REV	5-3/86



POWER CONNECTIONS
 GRD (N) -5V (U) (H)

REFS DRAWING NO. L-1048

VISUAL INFORMATION INSTITUTE, INC.
 XENIA, OHIO

V WINDOW BOARD

DATE	9-6-68
BY	9-6-68
REVISION	3-7/30

V WINDOW BOARD

11/24/70

MATERIAL LIST

3 IN4154
8 2N5134
2 2N5139

2 68

2 100

9 1K

2 2.7K

5 4.7K

2 10K

5 18K

1 33K

1 47K

1 100pf

1 0.001uf 100v.

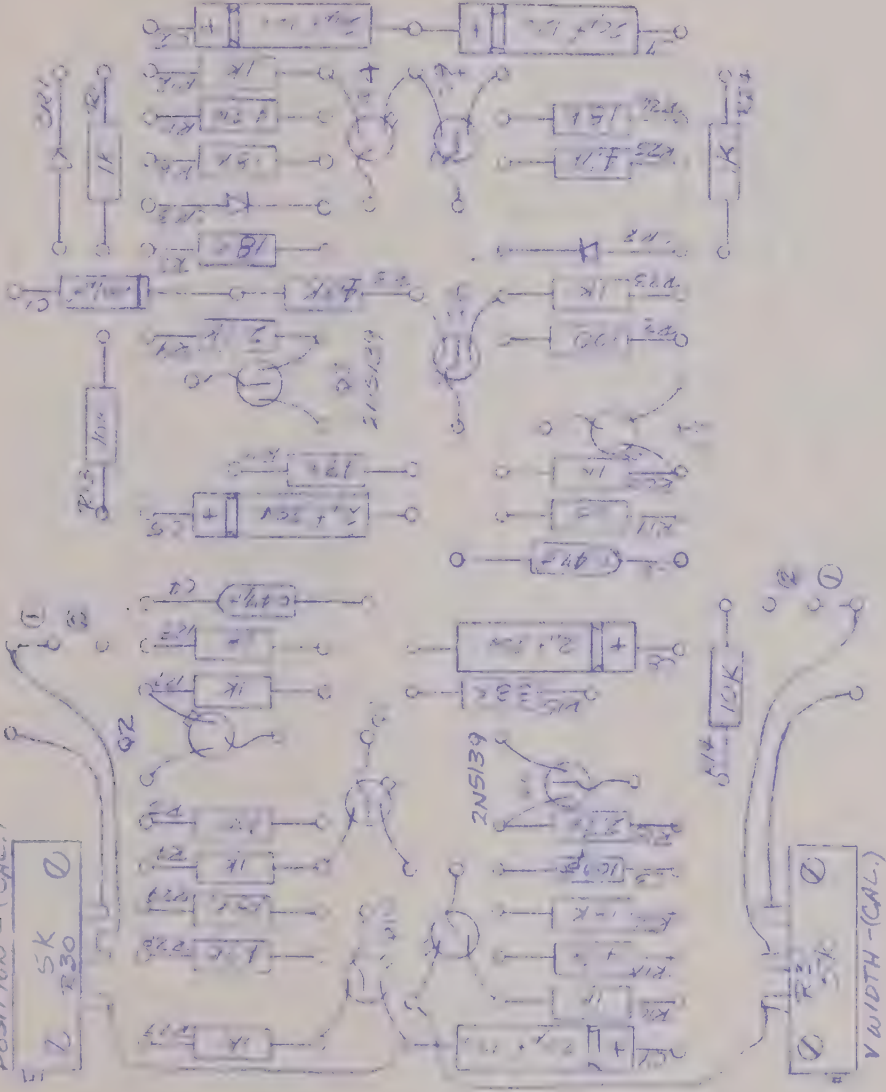
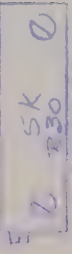
2 0.47uf 35v.

2 20uf, 25v.

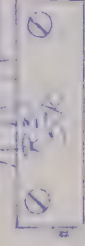
3 20uf, 12v.

105 TERMINALS

POSITION - (CAL.)



V WIDTH - (CAL.)



--- INSULATED WIRE, #24 STRANDED

--- UNINSULATED WIRE, #22 SOLID

NOTE: LINK ① PROVIDES INTERNAL POSITION & WIDTH CONTROL.

MOVE LINK TO ② FOR REMOTE FRONT PANEL CONTROL IF DESIRED

DWG. NO. L-1048

REF: SCHEMATIC S-0130

- 2 CAL IN
- Y CAL OUT
- X CONTROL OUT
- W VAR. IN
- V +V INPUT
- U CONTROL IN
- T V WIND. ON
- S -5v.
- R
- P
- N 1K
- M
- L 30V
- K
- J
- H -5v.
- F V WIND. ON
- E CONTROL IN
- D VAR. IN
- C CONTR OUT
- B CAL OUT
- A CAL IN

GRAY SCALE CONTROL

JHL 1/23/71

MATERIAL LIST

2N15139

2N3053

1N454

1N4816

4% 470

4% 207K

60

1 4.7K

2 10K

1 10K

1 77K

1 1.0K

1 330

1 100

1 1.5K

13 1K

2 2.2K

1 100K

1 100K

1 100K

1 100K

1 100K

1 100K

1 100K

1 100K

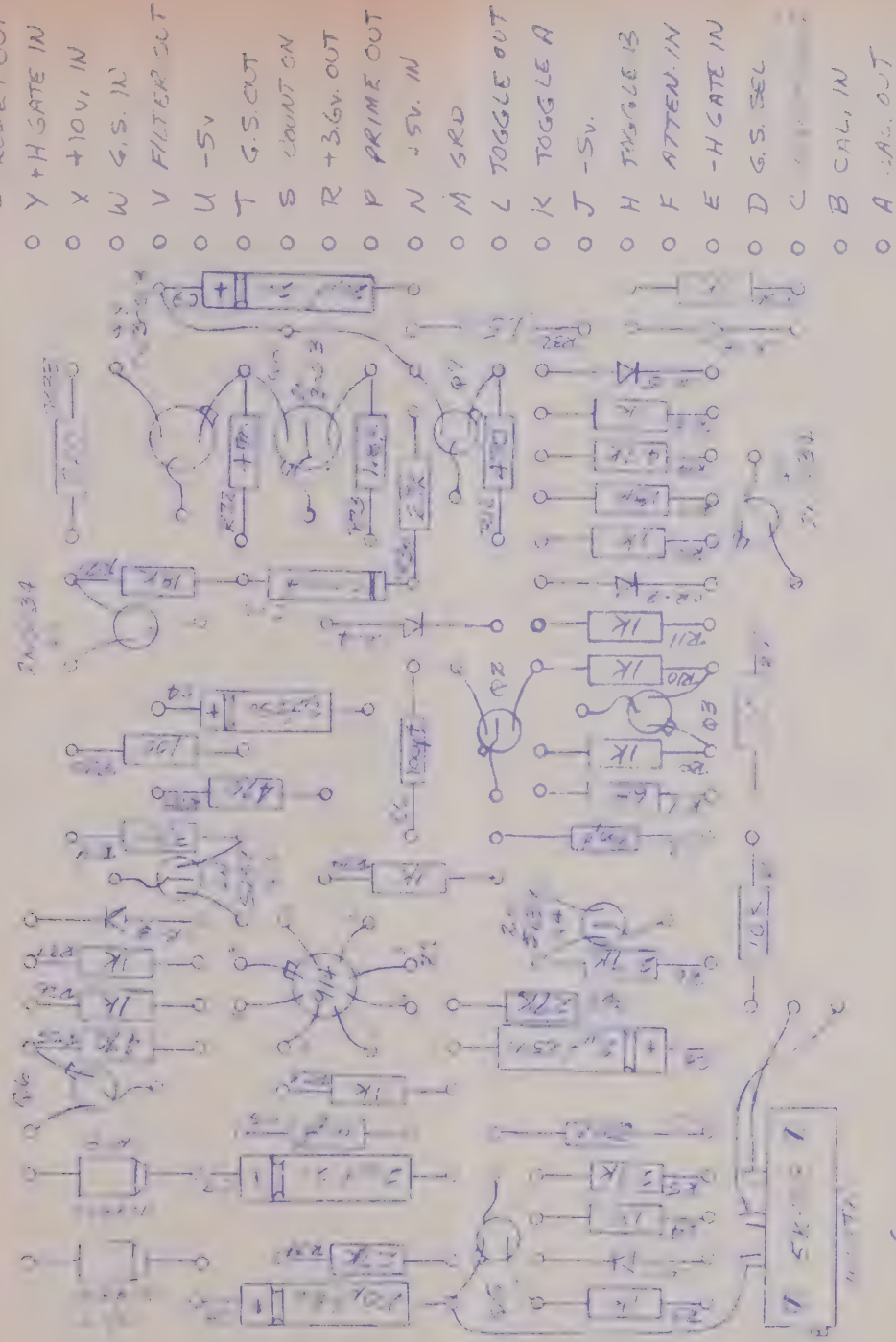
1 100K

1 100K

1 100K

DWG. NO. L-1053

REF: SCHEMATIC S-0124



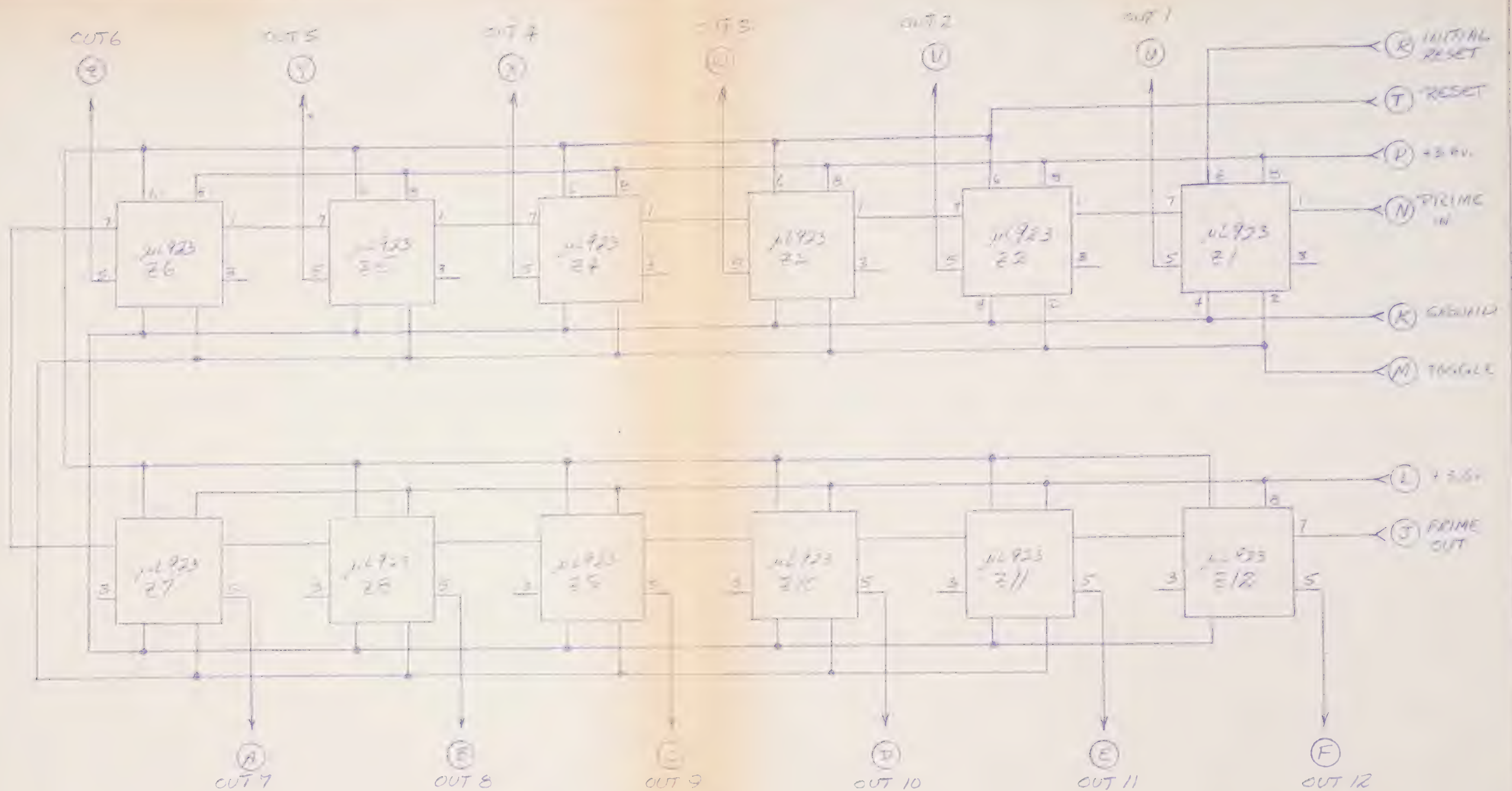
1-0.001 μ F @ 100V.

1-220

INSULATED WIRE, #20 STRANDED

157-TERMINALS

- Z RESET OUT
- Y +H GATE IN
- X +10V, IN
- W G.S. IN
- V FILTER OUT
- U -5V
- T G.S. OUT
- S COUNT ON
- R +3.6V. OUT
- P PRIME OUT
- N -5V. IN
- M GRD
- L TOGGLE OUT
- K TOGGLE A
- J -5V.
- H TOGGLE B
- F ATTEN. IN
- E -H GATE IN
- D G.S. SEL
- C
- B CAL. IN
- A CAL. OUT



7492 FAIRCHILD U8A59 723 28X J-K FLIP FLOP OR EQ. (RTL)

REF: DWG. NO. L-1063

VISUAL INFORMATION INSTITUTE, INC.
XENIA, OHIO

RING COUNTER BOARD

DATE	3-8-69
DATE	3-8-69
DWG. NO.	S-0219

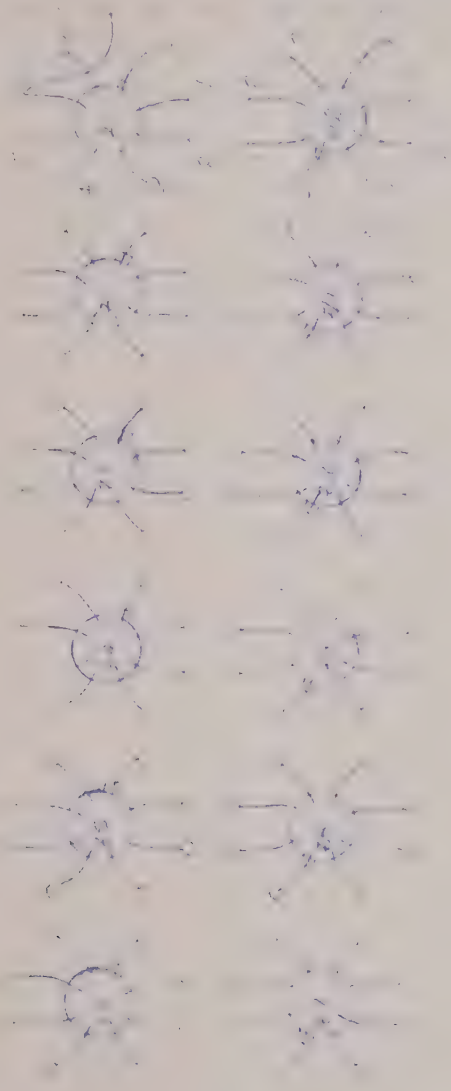
RING COUNTER
JH 3/6/69

DWG. L-106B

REF: SCHEMATIC S-CR19

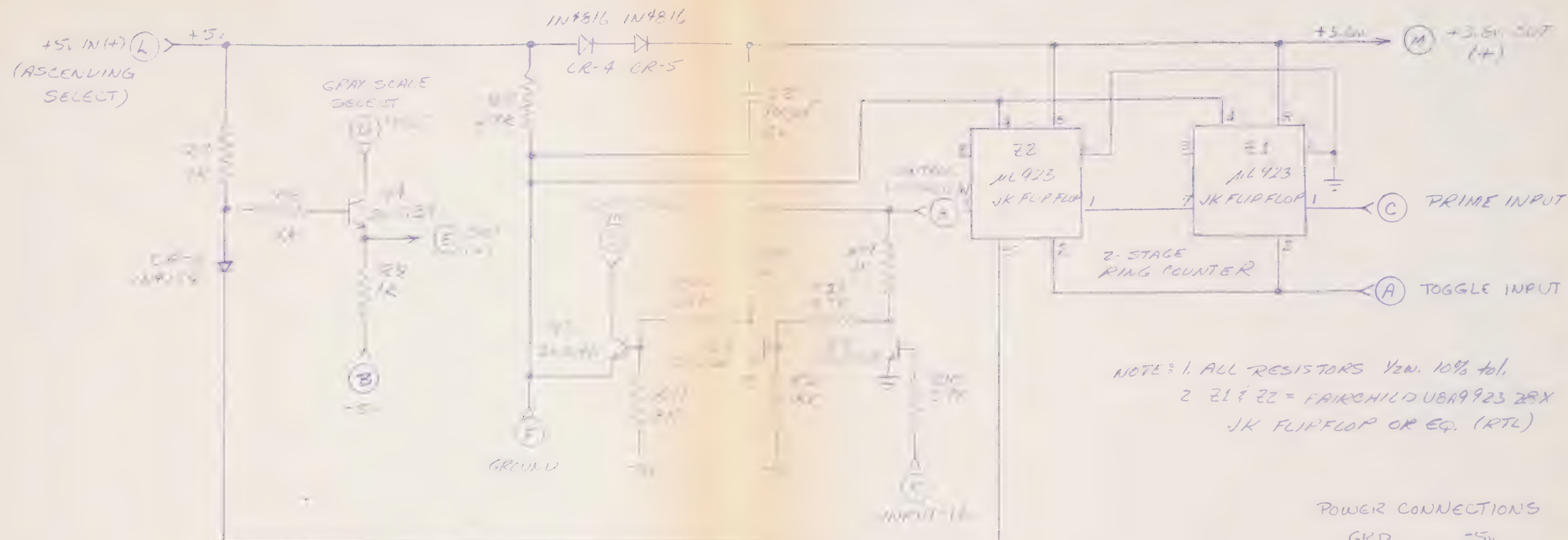
DATE: 3/6/69
BY: JH

Z	CUT 2
Y	CUT 5
X	CUT 4
W	CUT 3
V	CUT 2
U	CUT 1
T	RESET IN
S	SKV
R	INITIAL RESET
P	+ 3.6V
N	DRIVE IN
M	TOGGLE IN
L	+ 3.6V
K	DRIVE
J	DRIVE OUT
H	
F	
E	
D	
C	
B	
A	



— INSULATED WIRE, #24 STRANDED

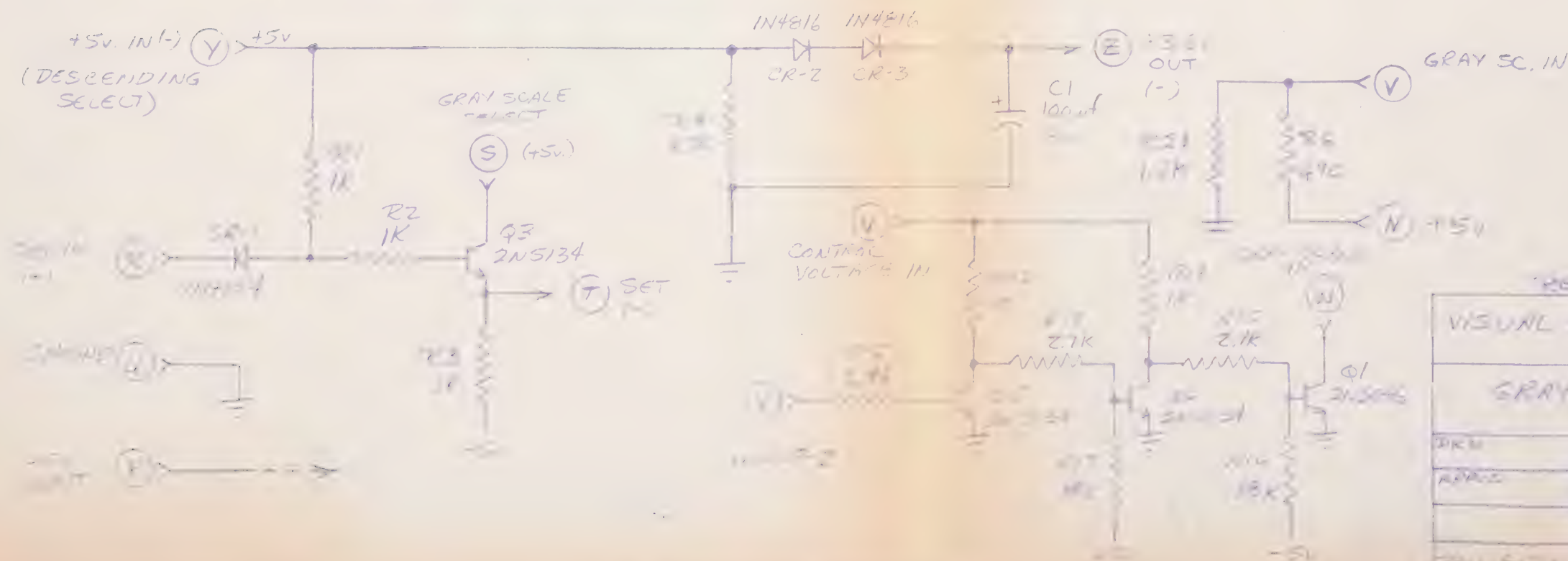
46 TERMINALS



NOTE: 1. ALL RESISTORS 1/2W. 10% tol.
2 Z1 & Z2 = FAIRCHILD U8A9923 2RX
JK FLIPFLOP OR EQ. (RTL)

POWER CONNECTIONS

GRD -5V.
(F) (E)
(U) (P)



REF. DUG NO. 2-1067

VISUAL INFORMATION INSTITUTE INC.
XENIA, OHIO

GRAY SCALE SELECT

DRW	SW	DATE	3-12-69
APPR	SW	DATE	3-12-65
REV 6-20-67		DUG NO.	5-0214

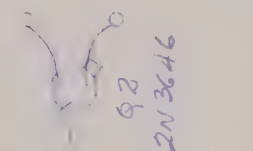
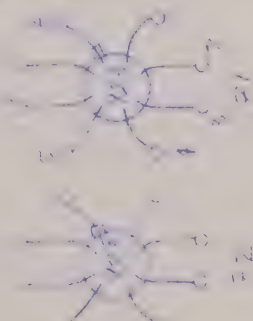
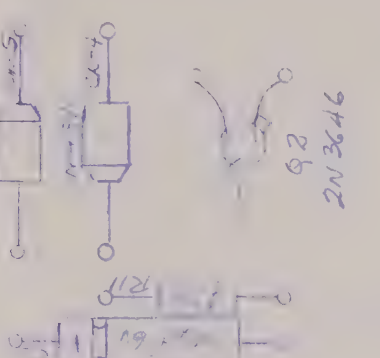
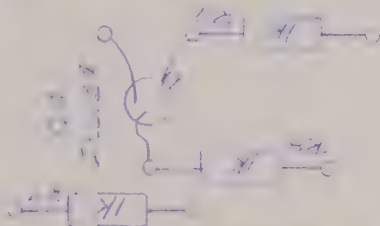
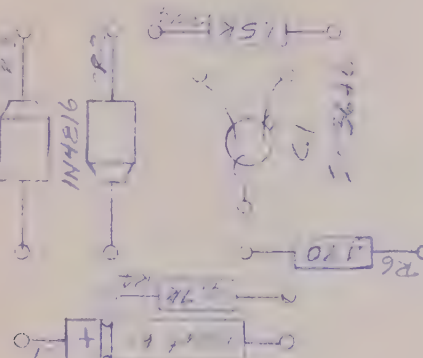
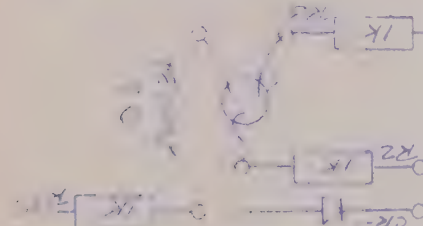
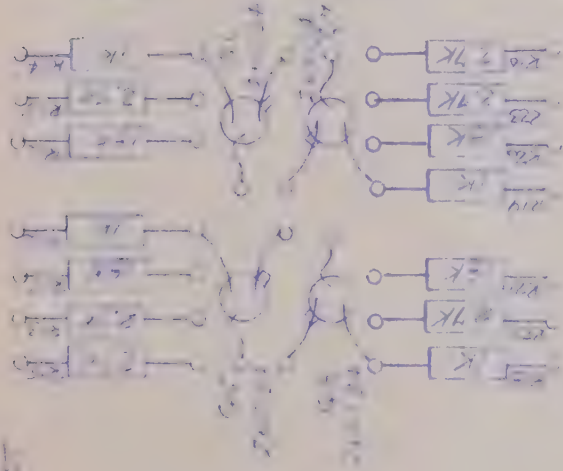
1735 30 15 10 25

11/20/70

[Faint handwritten notes or bleed-through from the reverse side of the page.]

11

11



1891

REF: SCHEMATIC S-0214

1

1N4E16

1

5K

17

七十五

710611

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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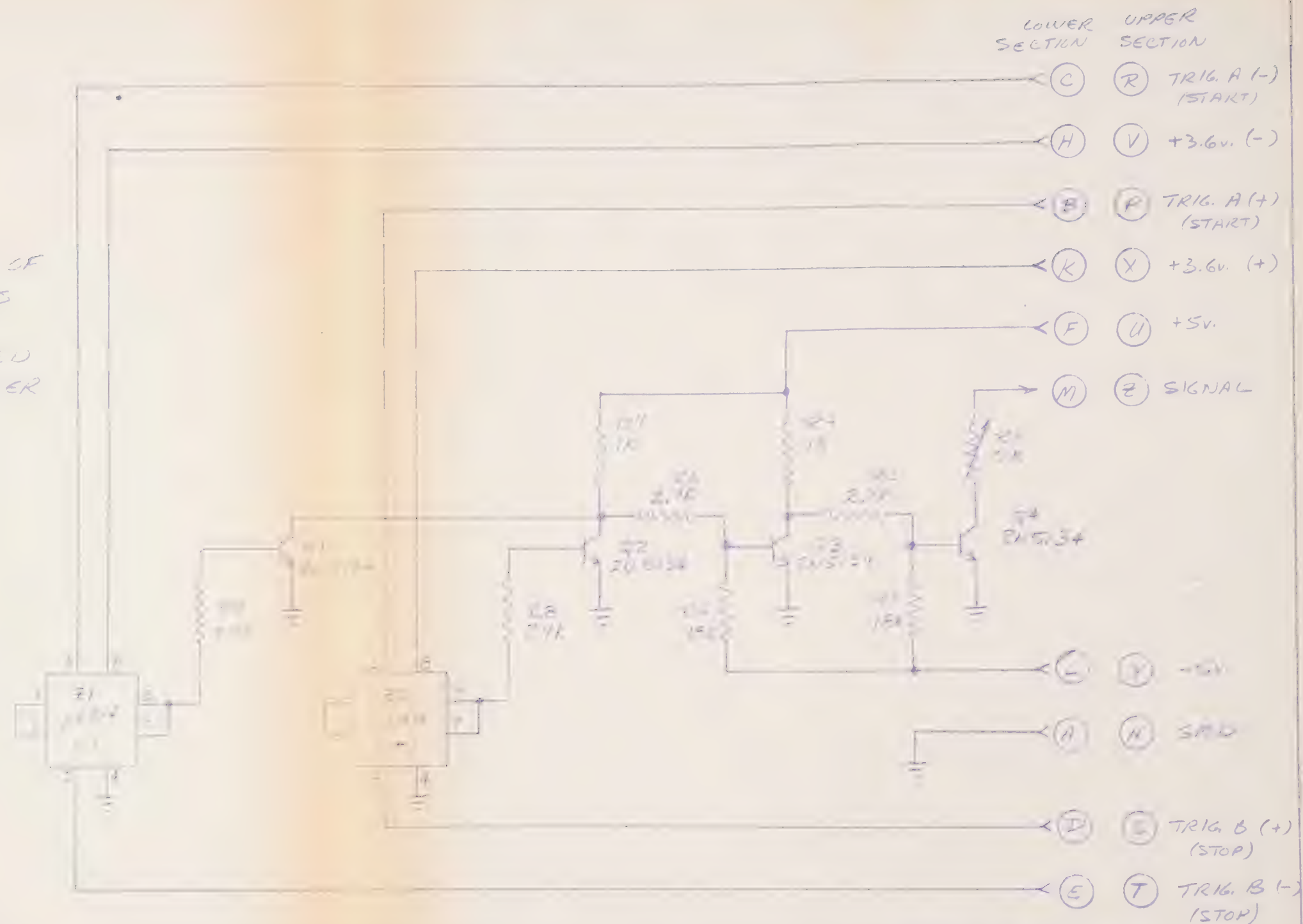
34

7

1

96 | TERMINALS

CIRCUIT BOARD IS COMPOSED OF TWO IDENTICAL SECTIONS, AS SHOWN, WITH APPROPRIATE PIN CONNECTIONS AS OUTLINED FOR EACH UPPER AND LOWER SECTIONS.



NOTES 1. PL 914 = FAIRCHILD U8A5991428X
R-S FLIP-FLOP OR EQUIV. (RTL)
2. ALL RESISTORS 1/2W 10% tol.

REF: DING M. L-1066	
VISUAL INFORMATION INSTITUTE, INC. XENIA, OHIO	
GARY = LATE BOARD	
DATE	3-12-68
TIME	3-12-68
FILE	5-52/5

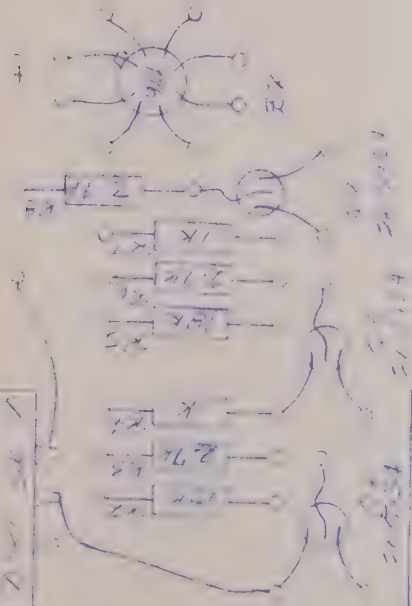
GRAY SCALE

6/20/69

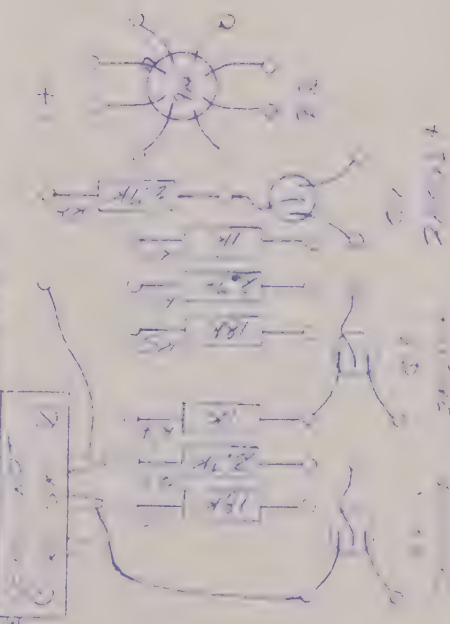
NATIONAL LIST

LEVEL ADT
2.5V 5V

4 PL 914 UPPER SECTION



LOWER SECTION



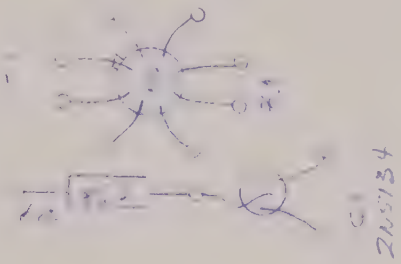
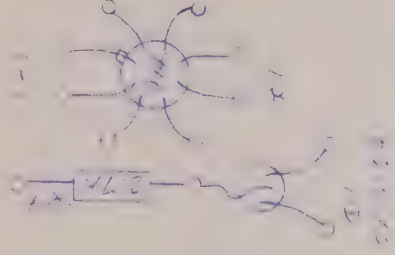
84 TERMINALS

INSULATED WIRE, #24 STRANDED

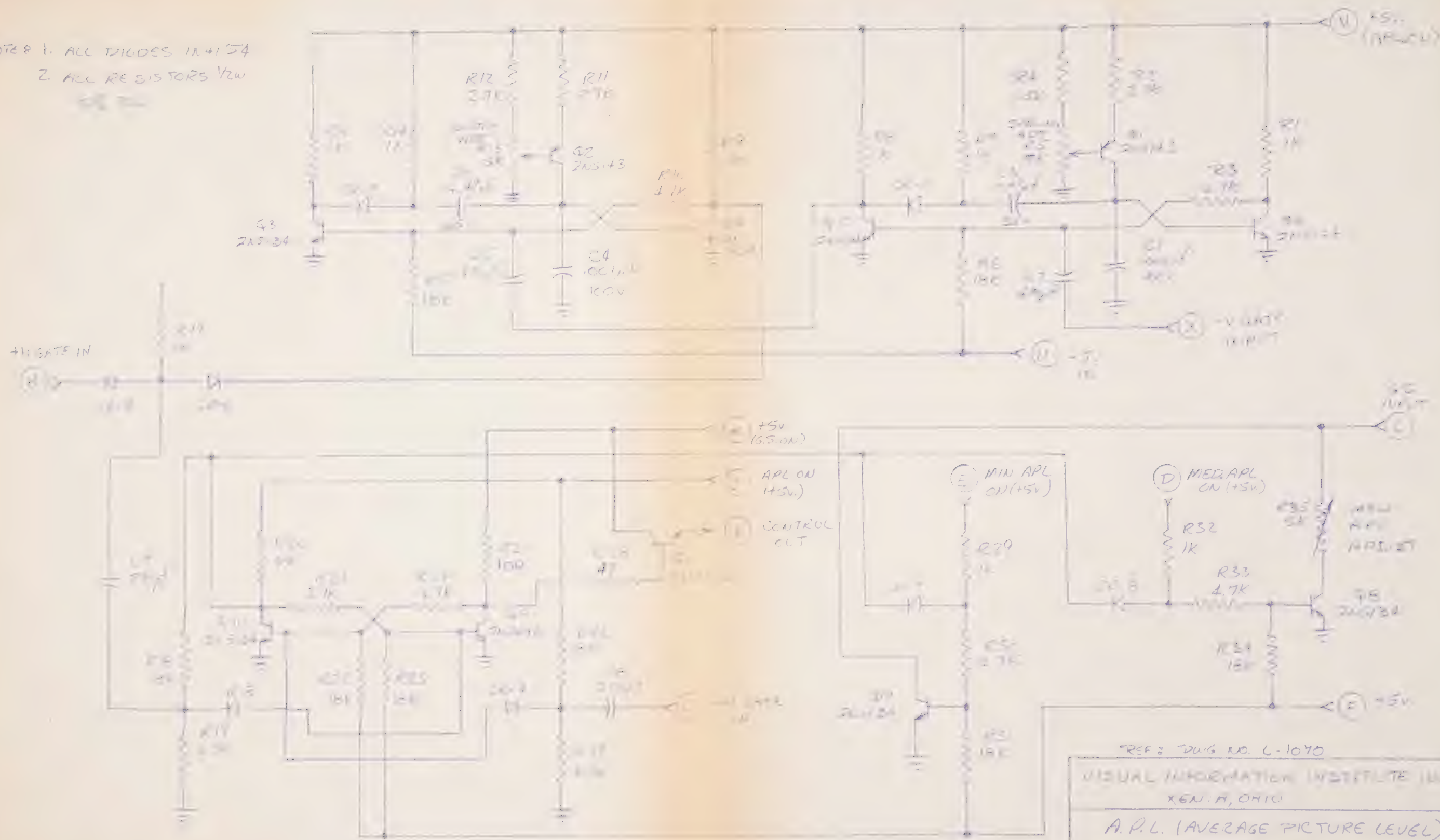
DWG. NO. L-1066

REF: SCHEMATICS-ORIS

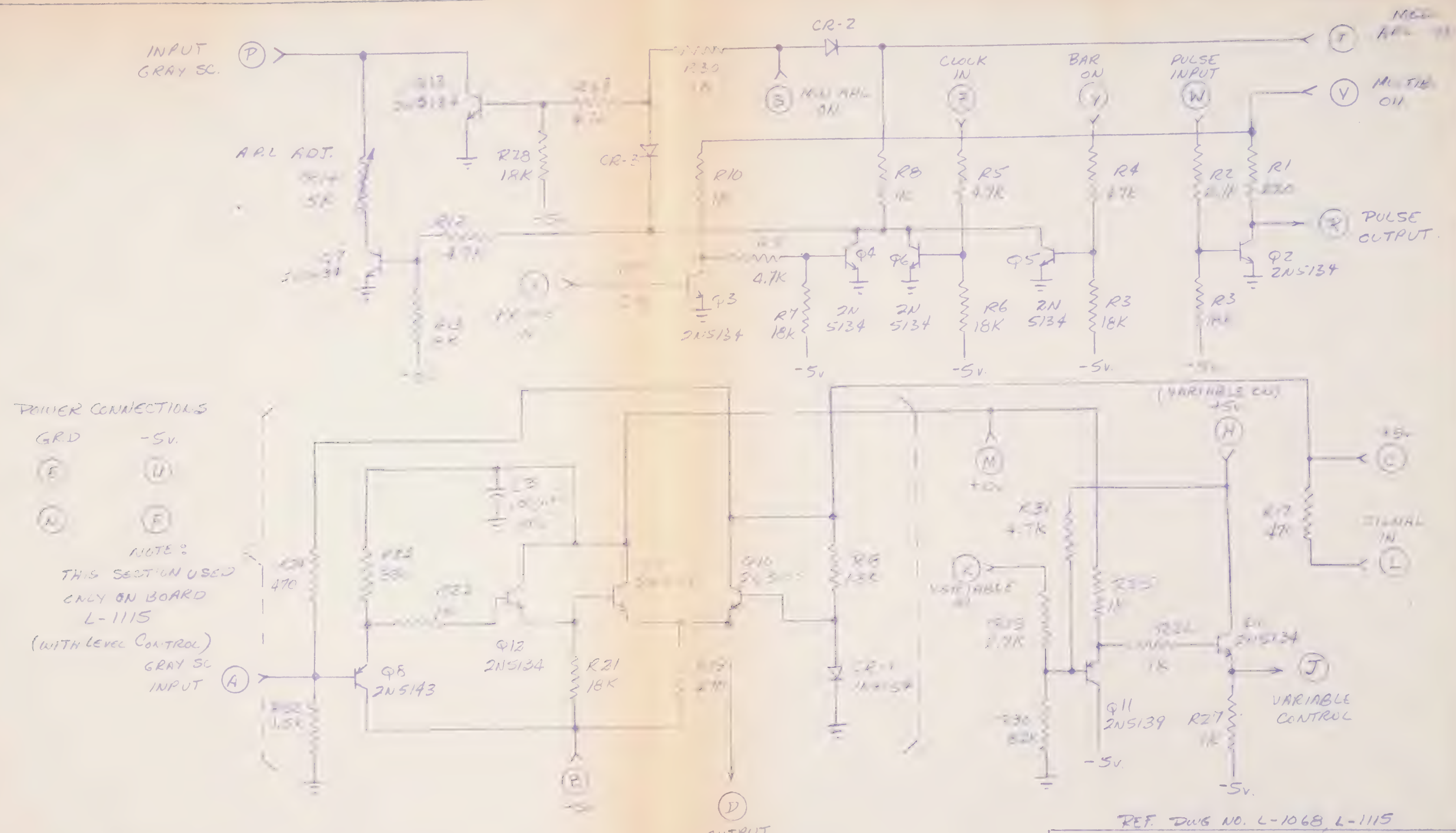
	GRAY SCALE
Y	-5V.
X	+3.6V. (+)
W	---
V	+3.6V. (-)
U	+5V.
T	TRIG B (-)
S	TRIG B (+)
R	TRIG A (-)
P	TRIG A (+)
N	GRD
M	GRAY SCALE
L	-5V
K	+3.6V. (+)
J	---
H	+3.6V. (-)
F	+5V.
E	TRIG B (-)
D	TRIG B (+)
C	TRIG A (-)
B	TRIG A (+)
A	GRD



NOTE 1. ALL DIODES 1N4154
2. ALL RESISTORS 1/2W



REF: DWG NO. C-1070	
VISUAL INFORMATION INSTITUTE INC.	
XENIA, OHIO	
A.P.L. (AVERAGE PICTURE LEVEL)	
BOARD	
DATE	6-30-69
DATE	6-30-69
DATE	6-30-69
DATE	6-30-69



NOTES: 1. ALL RESISTORS 1/2W. 10%
2. ALL DIODES 1N4154

REF. DWG NO. L-1068, L-1115	
VISUAL INFORMATION INSTITUTE, INC	
XENIA, OHIO	
RESOLUTION CONTROL	
DATE	3-25-67
DATE	3-25-67
DATE	3-02/8

RESOLUTION CONTROL

1/31/70

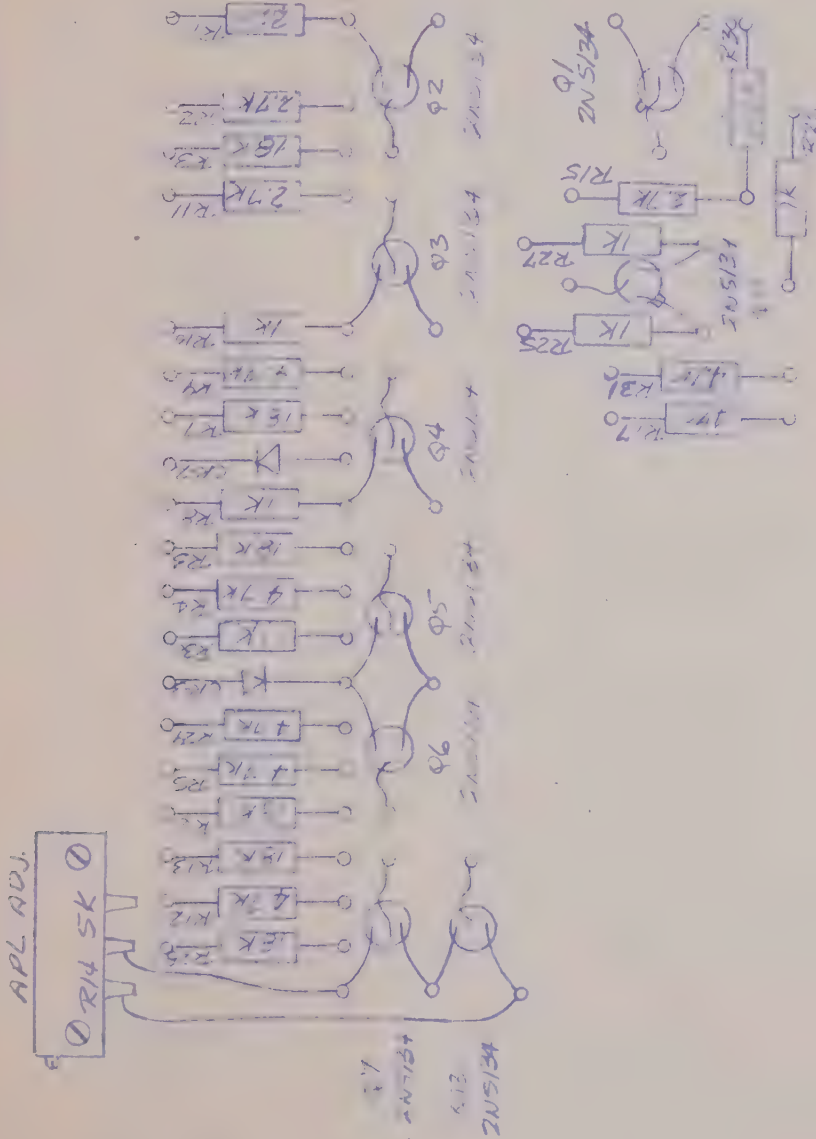
MATERIAL LIST

QTY	DESCR.
8	2N5134
1	2N7134
1	2N7134
1	2N7134
6	1K
6	4.7K
1	8.2K
6	16K

DWG NO. C-1048

REF: SCHEMATIC S-0213

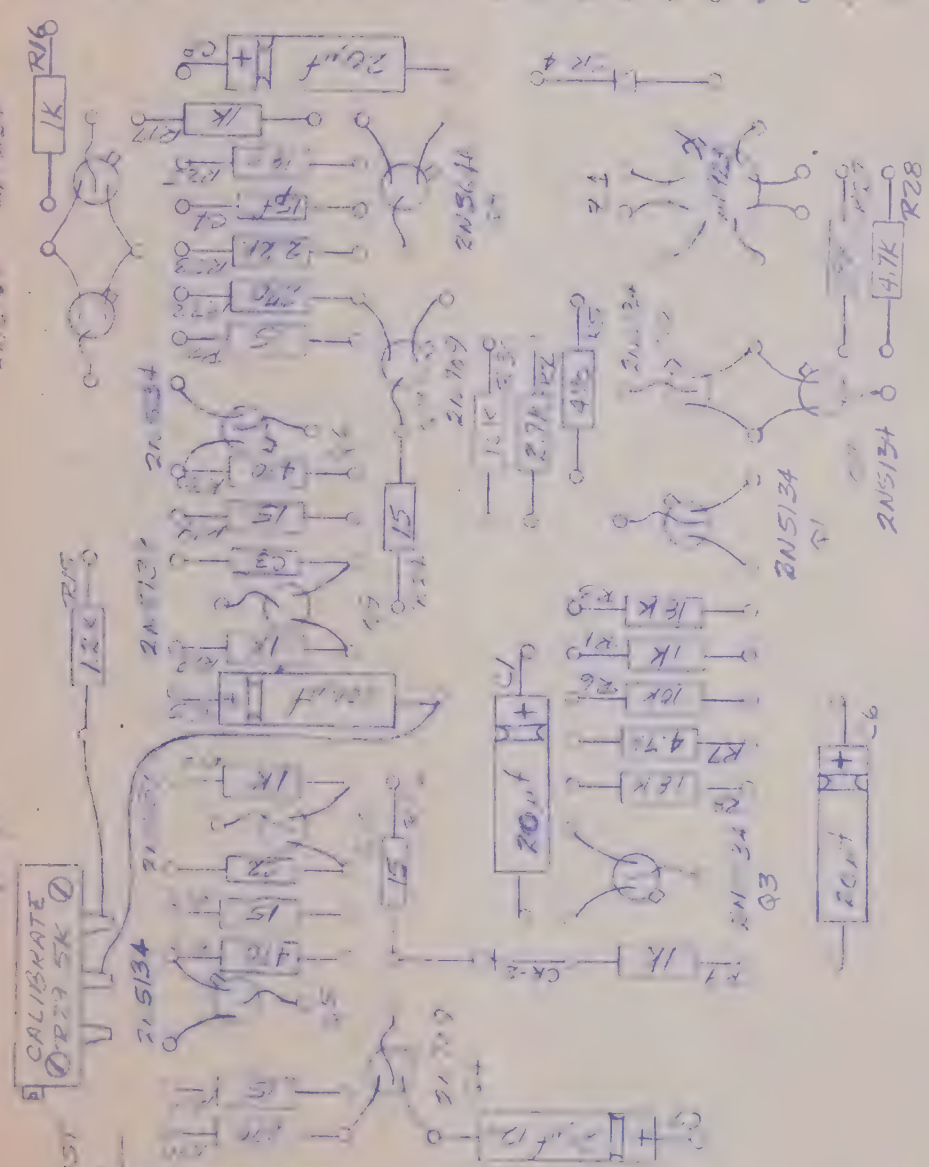
- 0 Y BHR ON
- 0 X PRIME IN
- 0 W PULSE IN
- 0 V MIN. APL ON
- 0 U -5V
- 0 T MAX. APL ON
- 0 S MIN. APL ON
- 0 R MAX. APL ON
- 0 P INPUT GND
- 0 N GRD
- 0 M +10V
- 0 L SIGNAL IN
- 0 K VAR IN
- 0 J RES. CONT.
- 0 H +5V (VAR. ON)
- 0 F -5V
- 0 E GRD
- 0 D
- 0 C +5V
- 0 B
- 0 A



RESOLUTION BOARD

3/30/77

CALIBRATE
R23 5K



- 4 20uF, 12v.
- 1 100uF, 6v
- 1 15pF

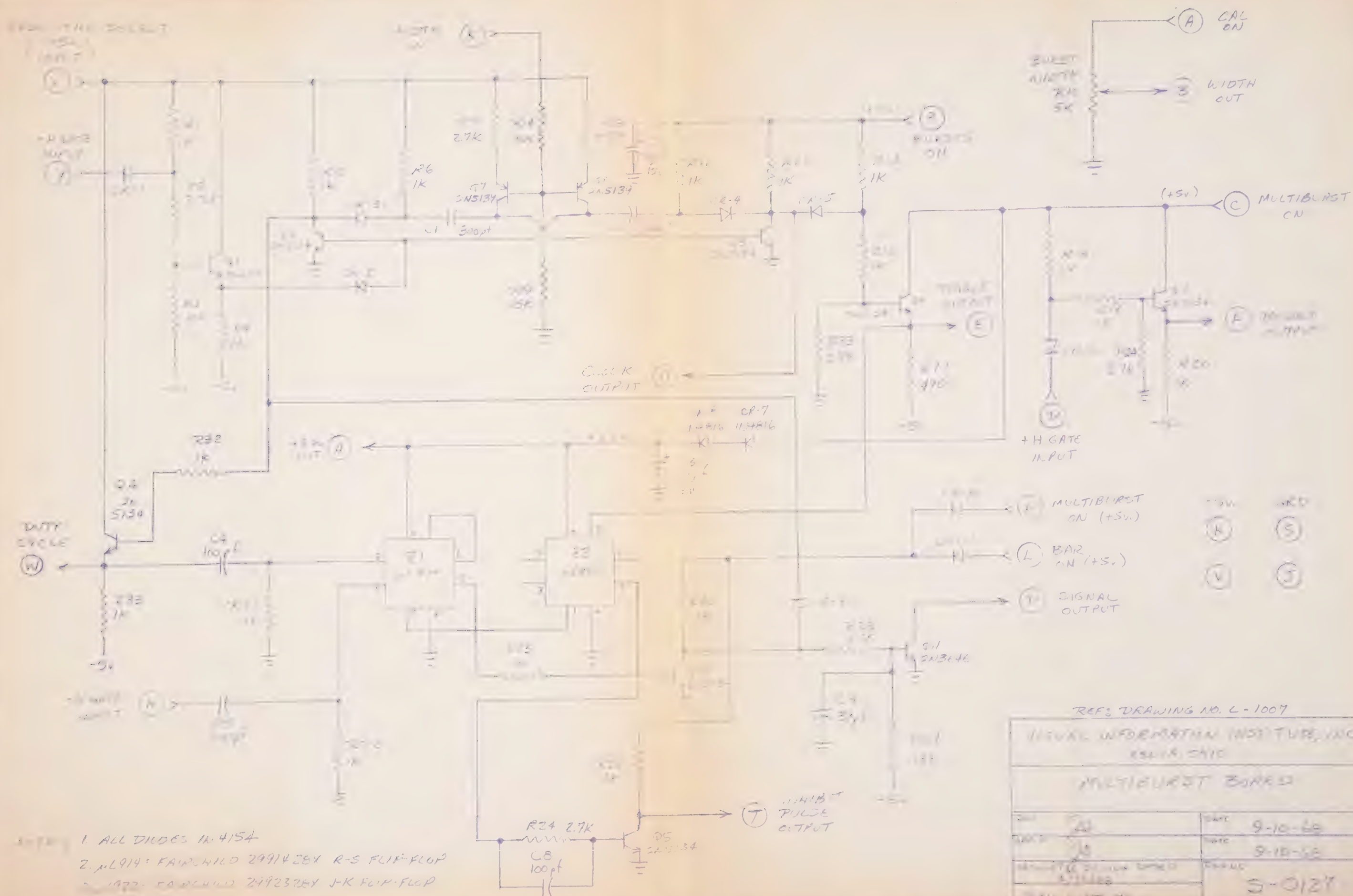
107 TERMINALS

____ INSULATED WIRE, #24 STRANDED

DWG. NO. L-100B
REF. SCHEMATIC S-0186

- Q1 Y VARIABLE
- Q2 X CALIBRATE
- Q3 -
- Q4 +5v
- Q5 -
- Q6 -
- Q7 -
- Q8 -
- Q9 AUTOREF
- Q10 +5v
- Q11 N +5v
- Q12 -
- Q13 -
- Q14 -
- Q15 -
- Q16 -
- Q17 -
- Q18 -
- Q19 -
- Q20 -
- Q21 -
- Q22 -
- Q23 -
- Q24 -
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- Q96 -
- Q97 -
- Q98 -
- Q99 -
- Q100 -

NOTES - C2, C3 SELECTED FOR DWG. L-100B
- Q4, Q7 MAY BE 2N2784 FOR HIGHER RATES.

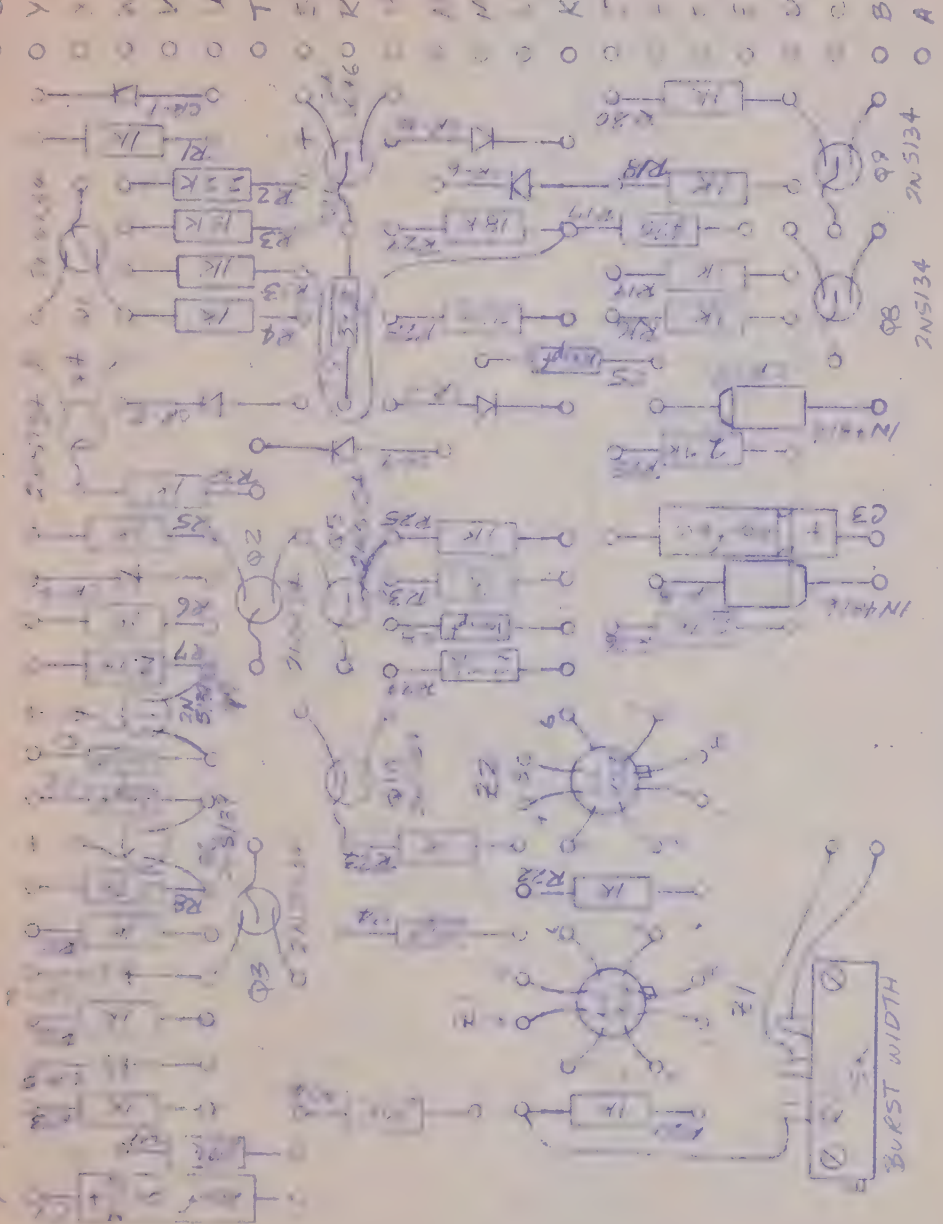


1. ALL DIODES IN 4154
2. PL914: FAIRCHILD 2991428X R-S FLIP-FLOP
3. 1972: FAIRCHILD 2492328X J-K FLIP-FLOP

MULTIBURST BOARD
12/20/70

DRWG. NO. L-1007
REF: SCHEMATIC S-0127

BURST ON
- HEATE IN
- 15V
- 5V
PULSE
M.B. IN
- 4V
- 1V
- 0.5V
WIDTH IN
- 1V
- 0.5V
- 0.2V
- 0.1V
WIDTH
FIXED ON



INSULATED WIRE,
#24 STRANDED

133 TERMINALS

MULTIBURST CONTROL

12/10/70

MATERIAL LIST

2N5134

μL923

27K

500μf 25v

DWG NO. C-1123
REF. SCHEMATIC NO. S-0284

- 0 Z ---
- 0 Y UNREG IN
- 0 X ---
- 0 W ---
- 0 V ---
- 0 U ---
- 0 T ---
- 0 S ---
- 0 R ---
- 0 P ---
- 0 N
- 0 M GRD
- 0 L CONTROL
- 0 K RESET
- 0 J ---
- 0 H +3.6v
- 0 F ---
- 0 E PRIME
- 0 D TOGGLE
- 0 C GRD
- 0 B ---
- 0 A ---

